



VEOLIA Water Technologies & Solutions

Membrane Bioreactor, MBR and LEAPmbr

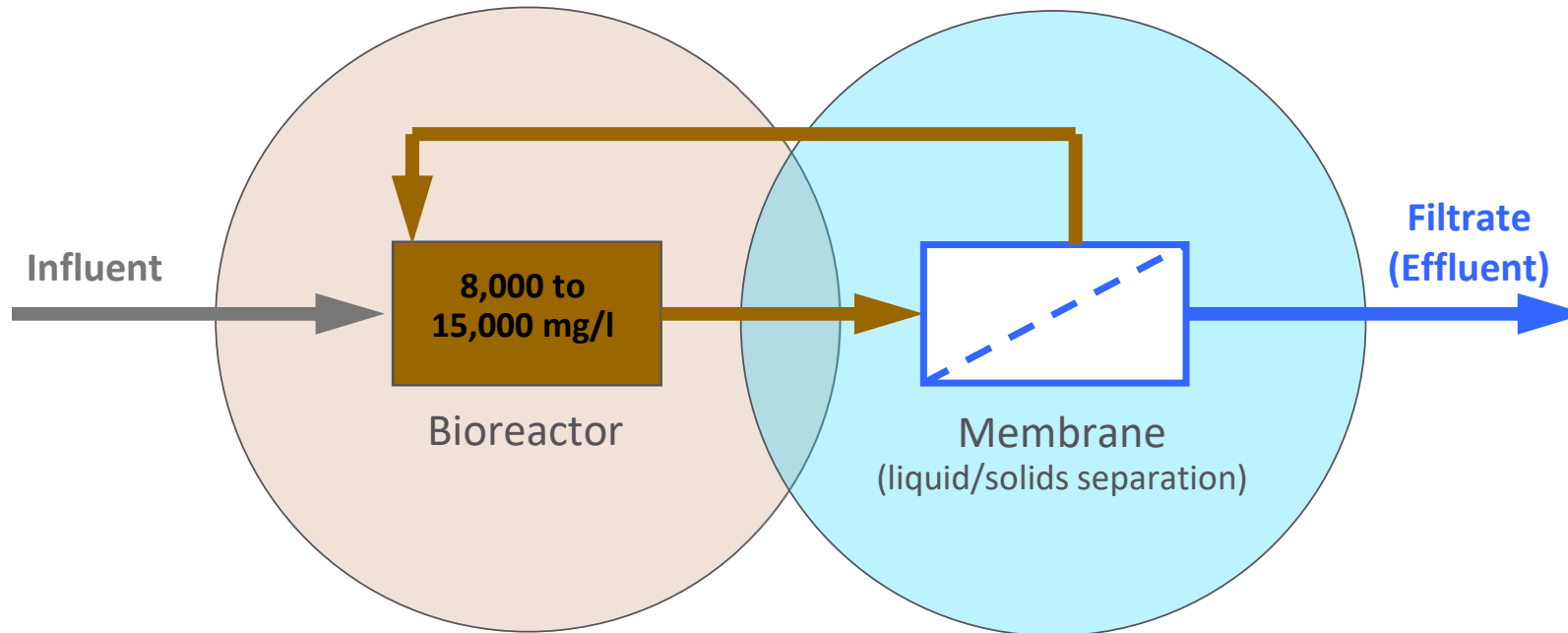




Membrane Bioreactor, MBR



Membrane Bioreactor, MBR



Hi-Rate Biological Treatment

- large capacity throughput
- compact footprint
- advanced treatment
- simpler, more reliable process

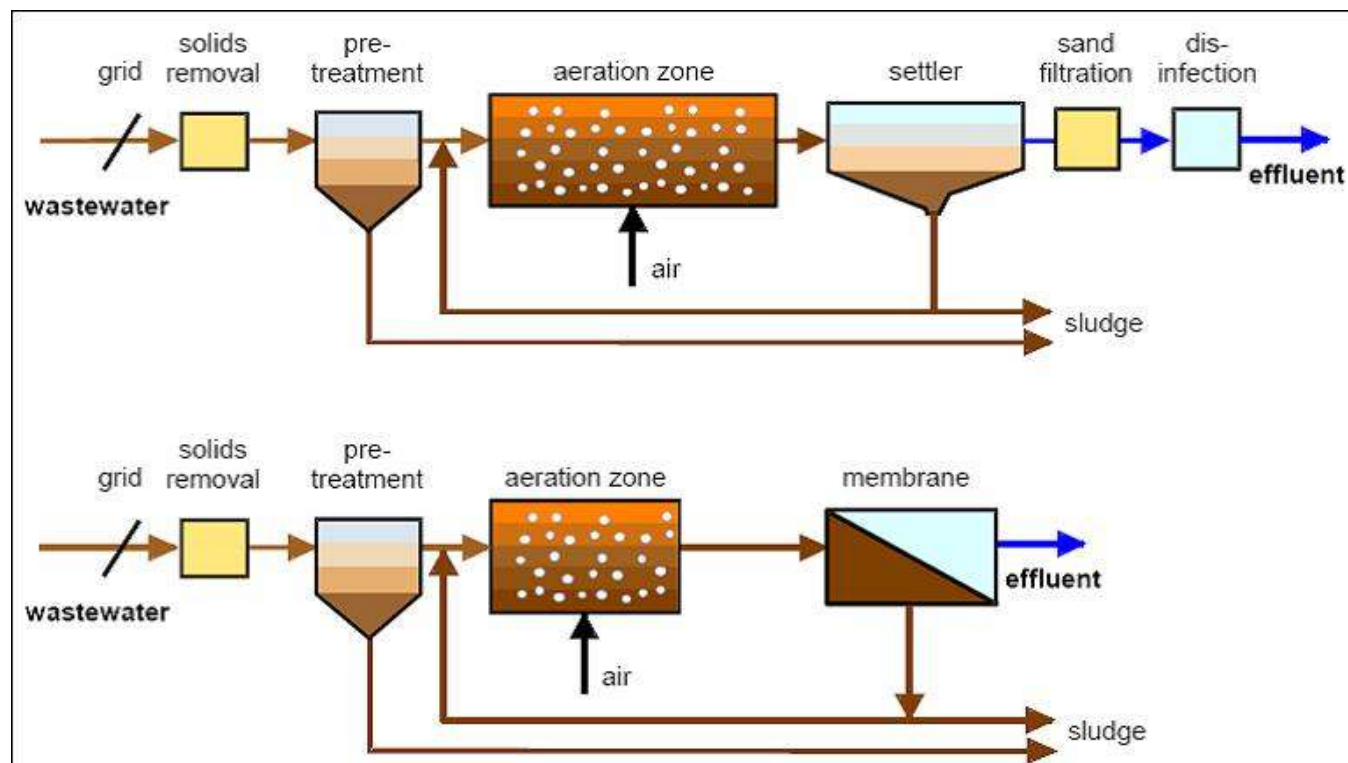
Absolute / Positive Filter

- high degree of biomass/solids control
- consistently high effluent quality
- lower operator attention - less components

Differences Between CAS & MBR

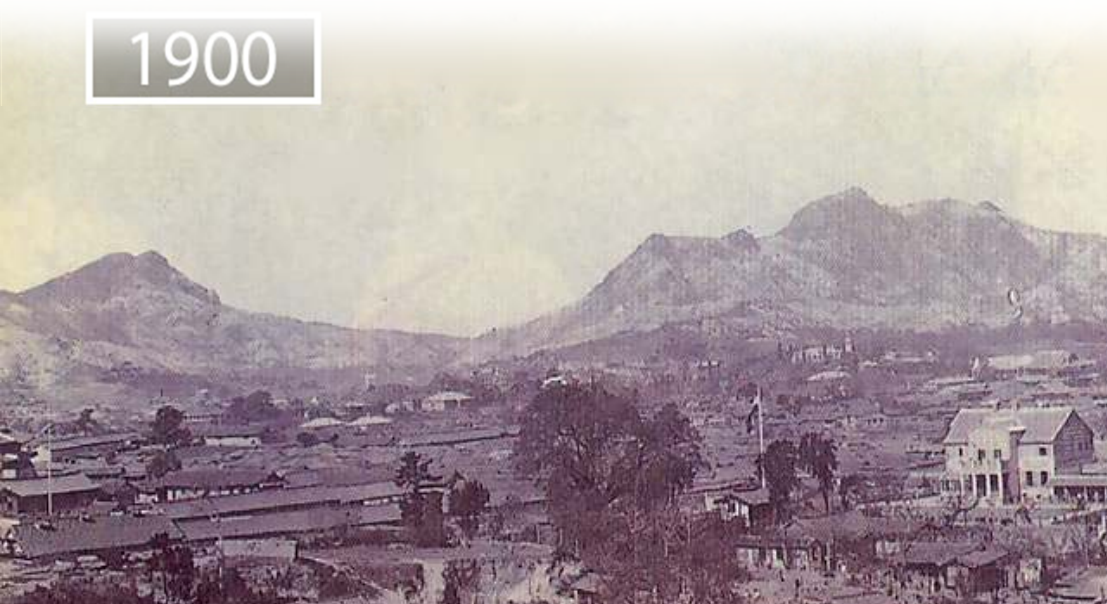
WHAT IS MBR?

- Combination of conventional biological treatment & physical liquid–solid separation using membrane filtration in one system
- Replaces secondary clarifiers & filters, and reduces bioreactor size
- Simple & reliable process
- Produces high quality effluent at all times



Process Intensification

1900

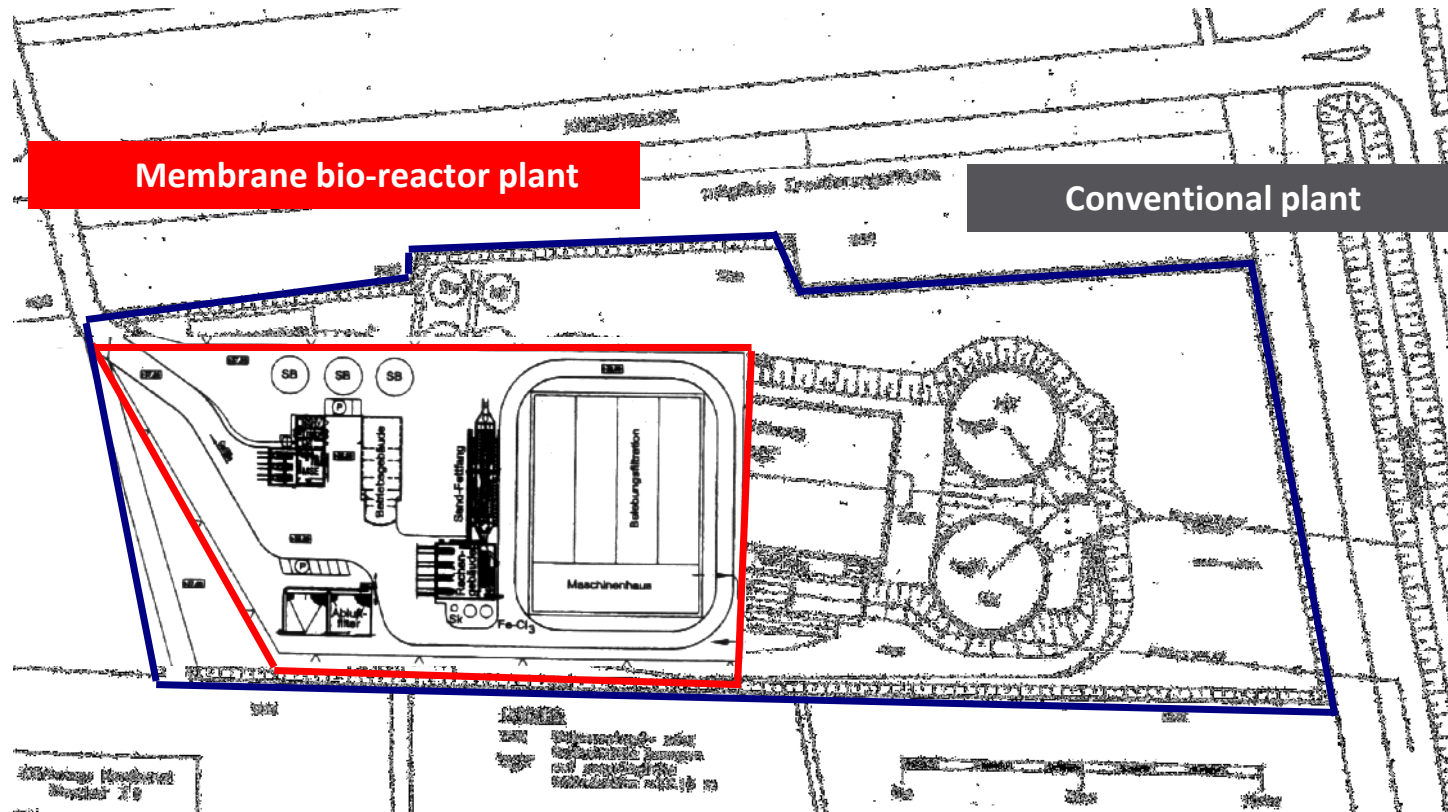


Now



doing more work within the existing plant footprint

Membrane vs. Conventional Layout



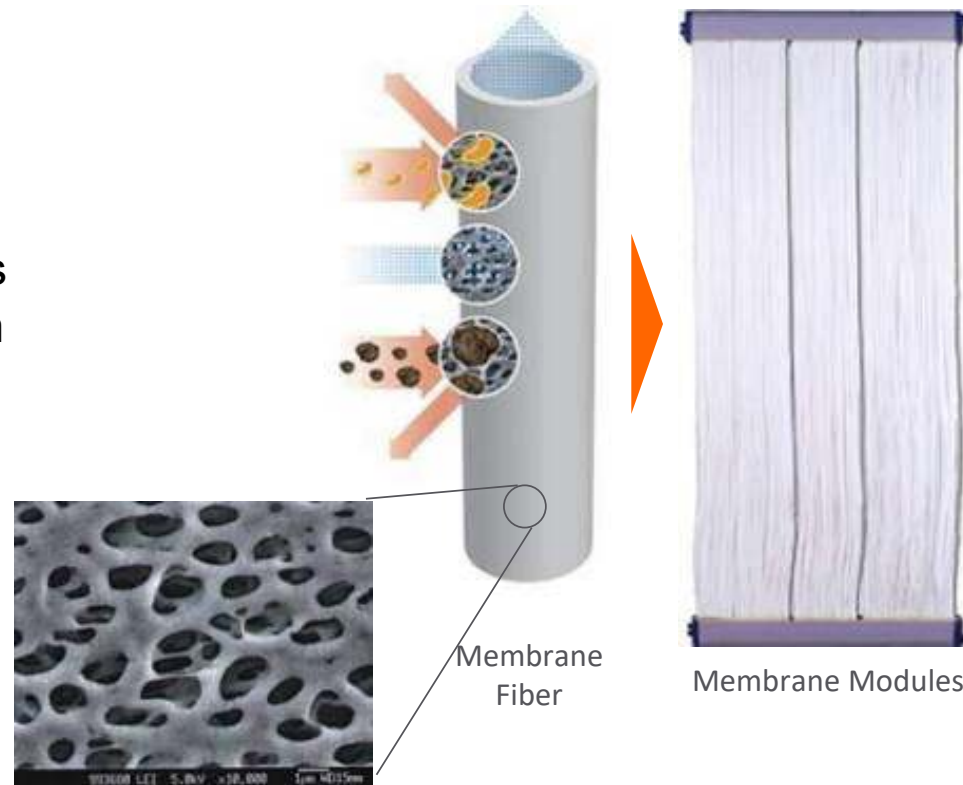
Membranes are the Key to Superior Permeate Quality

Hollow strands of porous plastic fibers with billions of microscopic pores on the surface

The pores are thousands of times smaller in diameter than a human hair

Pores form a physical barrier to impurities but allow pure water molecules to pass

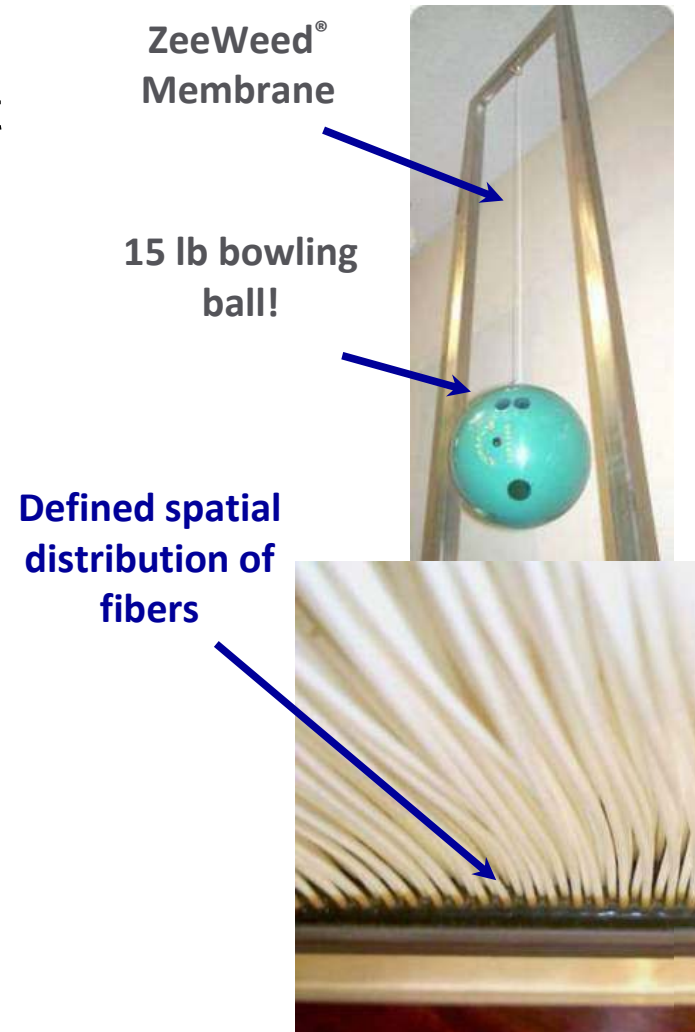
Clean water is drawn to the inside of fiber by a gentle suction



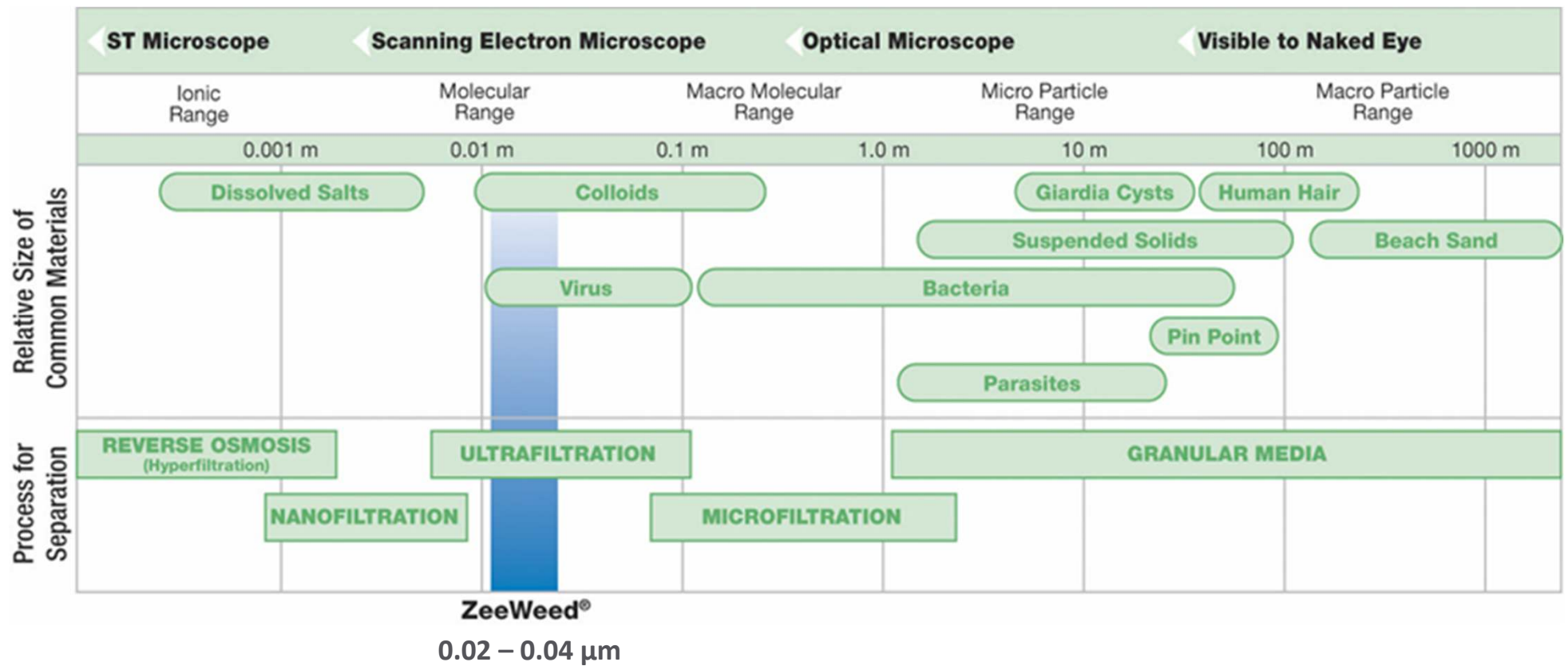
Electron microscope view of membrane surface

Key Differentiators of ZeeWeed[®] 500D

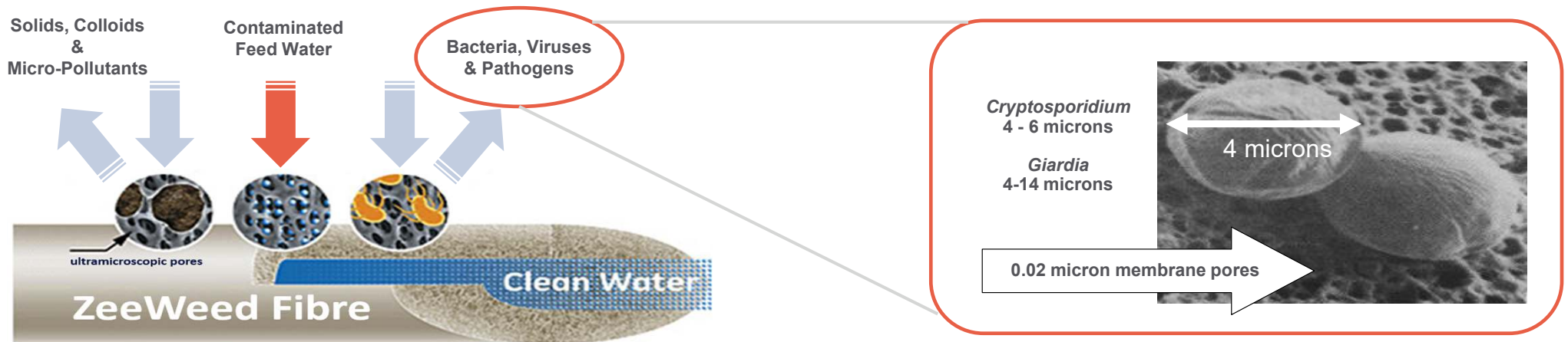
- Most robust product with strongest fiber in the industry
- Highest solids tolerance (can handle < 1 mg/L to 50,000 mg/L solids)
- Oxidant resistant (500,000 mg-hr Cl₂)
- Compatible with many coagulants & powdered activated carbon



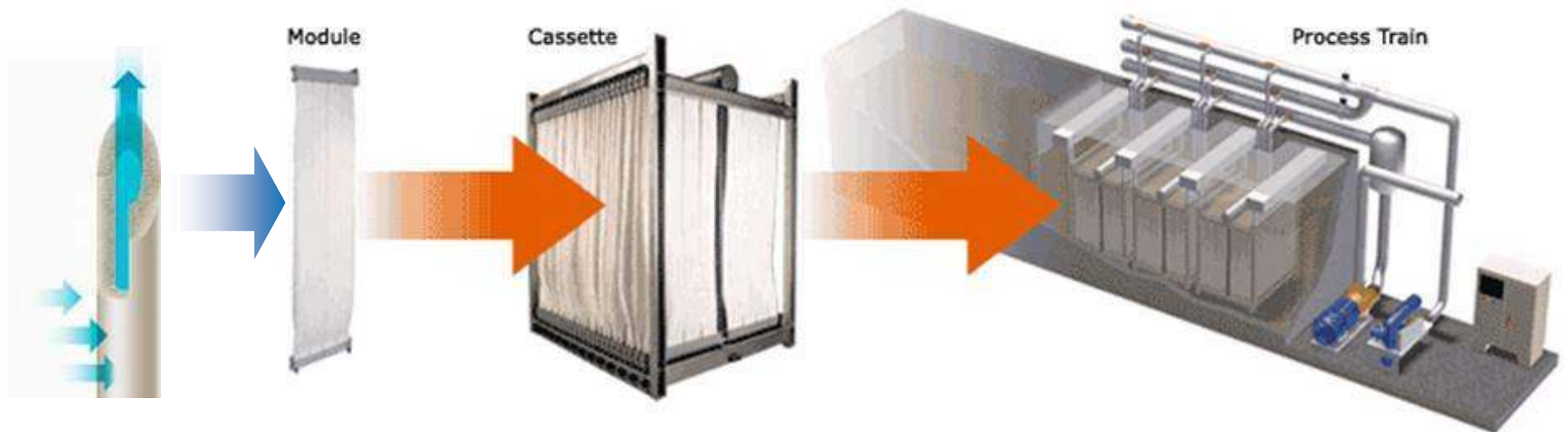
Filtration Spectrum



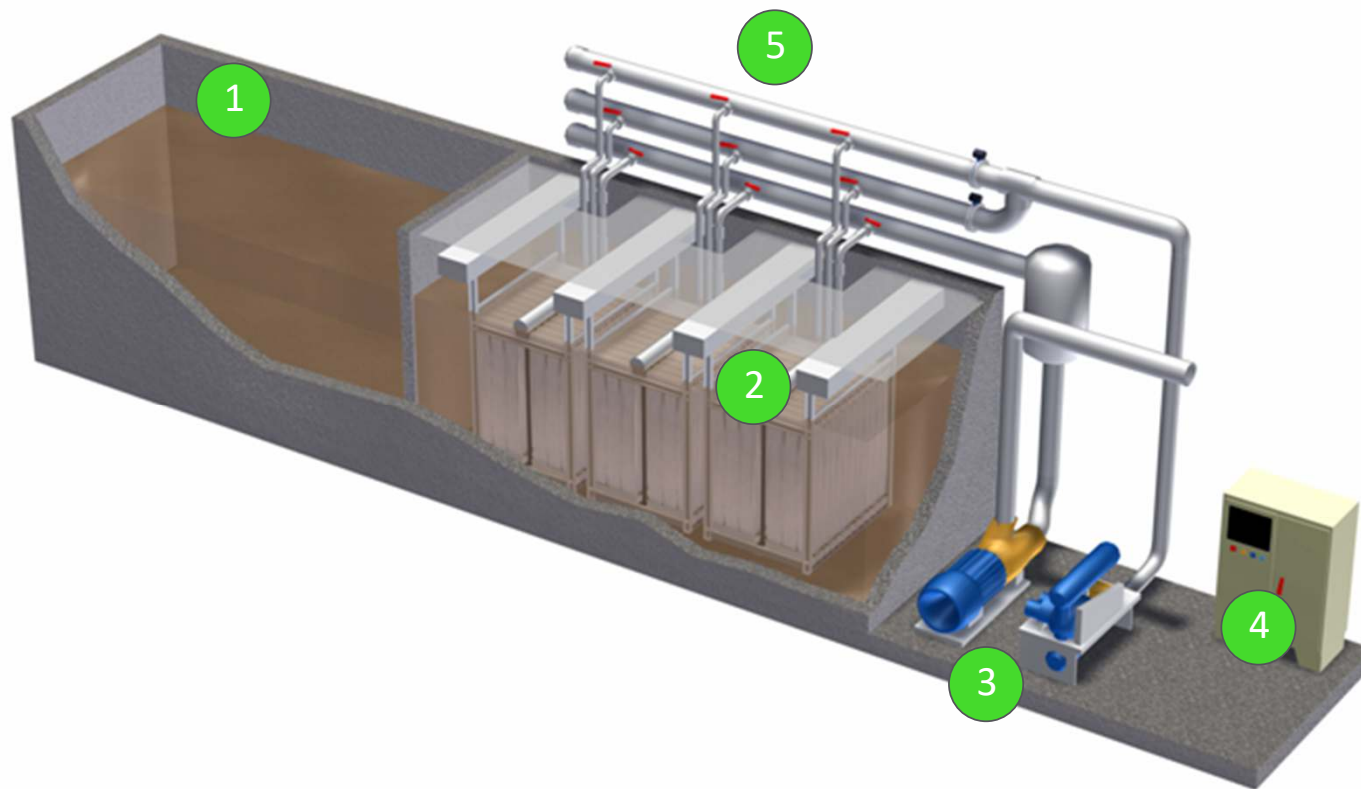
ZEEWEED ULTRAFILTRATION THE IDEAL PHYSICAL BARRIER



ZEEWEED 500 BUILDING BLOCK CONCEPT

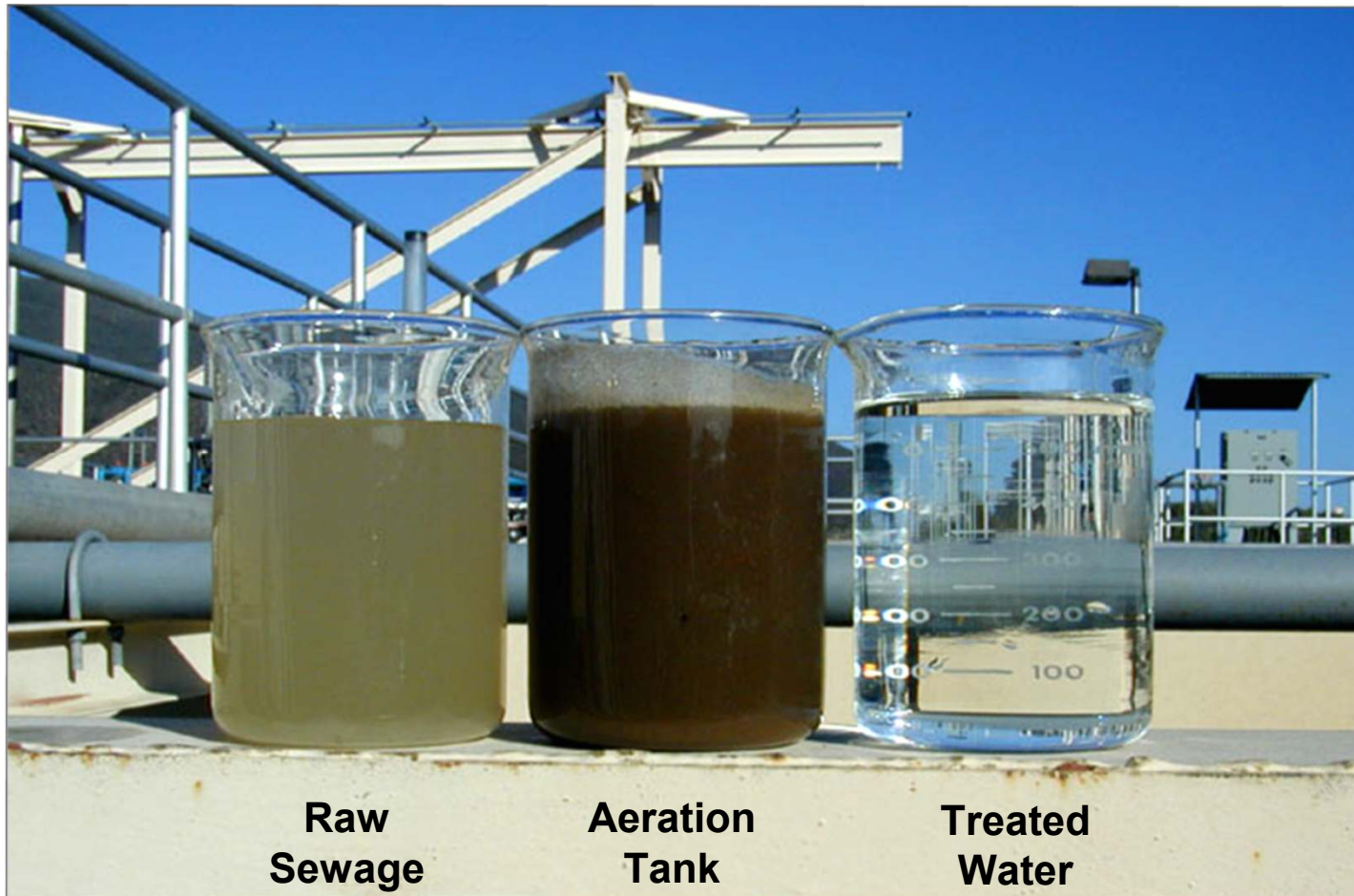


Basic MBR Production Train



1. Biological reactor
2. Membranes
3. Permeate pump & air blower
4. Control panel
5. Permeate & air piping

Treated Water Quality Consistently Exceed World's Toughest Standards



**Raw
Sewage**

**Aeration
Tank**

**Treated
Water**

Wastewater Treatment with a ZeeWeed[®] MBR – Effluent Quality

Suspended Solids	< 3	mg/L
BOD ₅	< 5	mg/L
NH ₄ -Nitrogen	< 1	mg/L
Total Nitrogen	< 5	mg/L
Total Phosphorus	< 0.1 - 0.2	mg/L
Turbidity	< 0.5	NTU
Silt Density Index	< 2 - 3	

* for treatment of municipal sewage



Advantages of MBR Technology vs. CAS



Achieves secondary and tertiary treatment in one compact step

Footprint



Cost



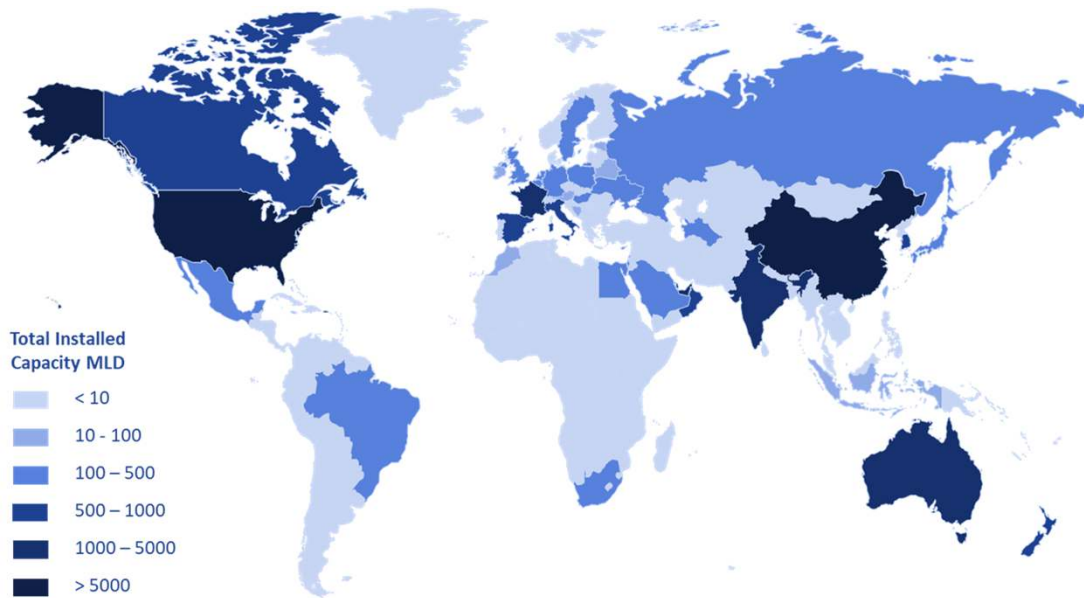
Reliability



Effluent Quality

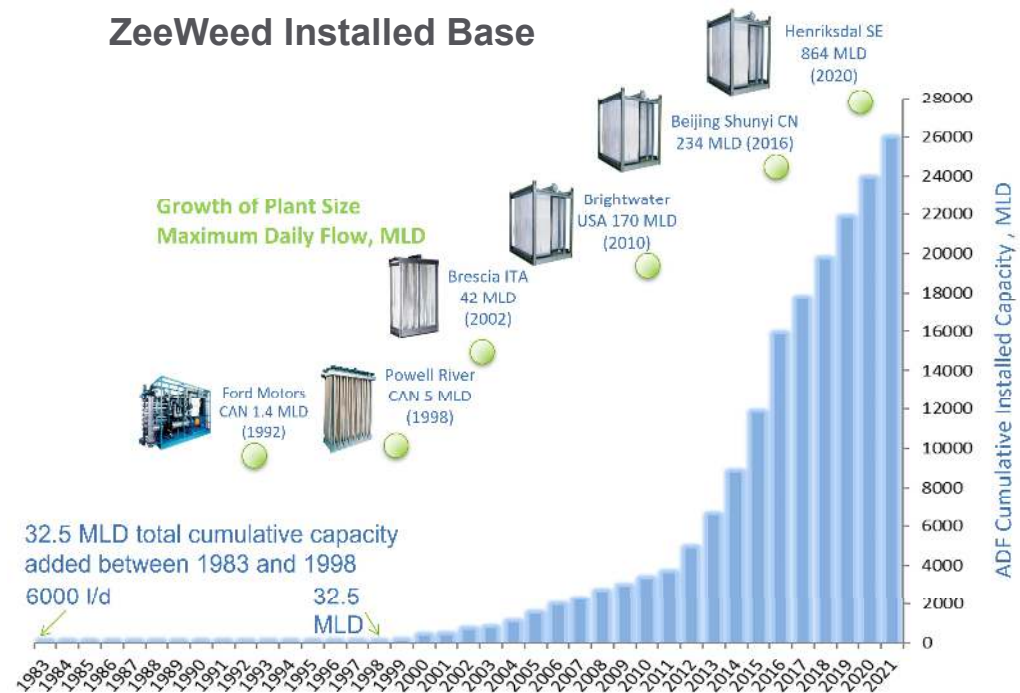


GLOBAL ADOPTION MBR'S ARE BEING BUILT ACROSS THE GLOBE



Installed Base of All MBR's
(ZeeWeed & Competitors)

ZeeWeed Installed Base

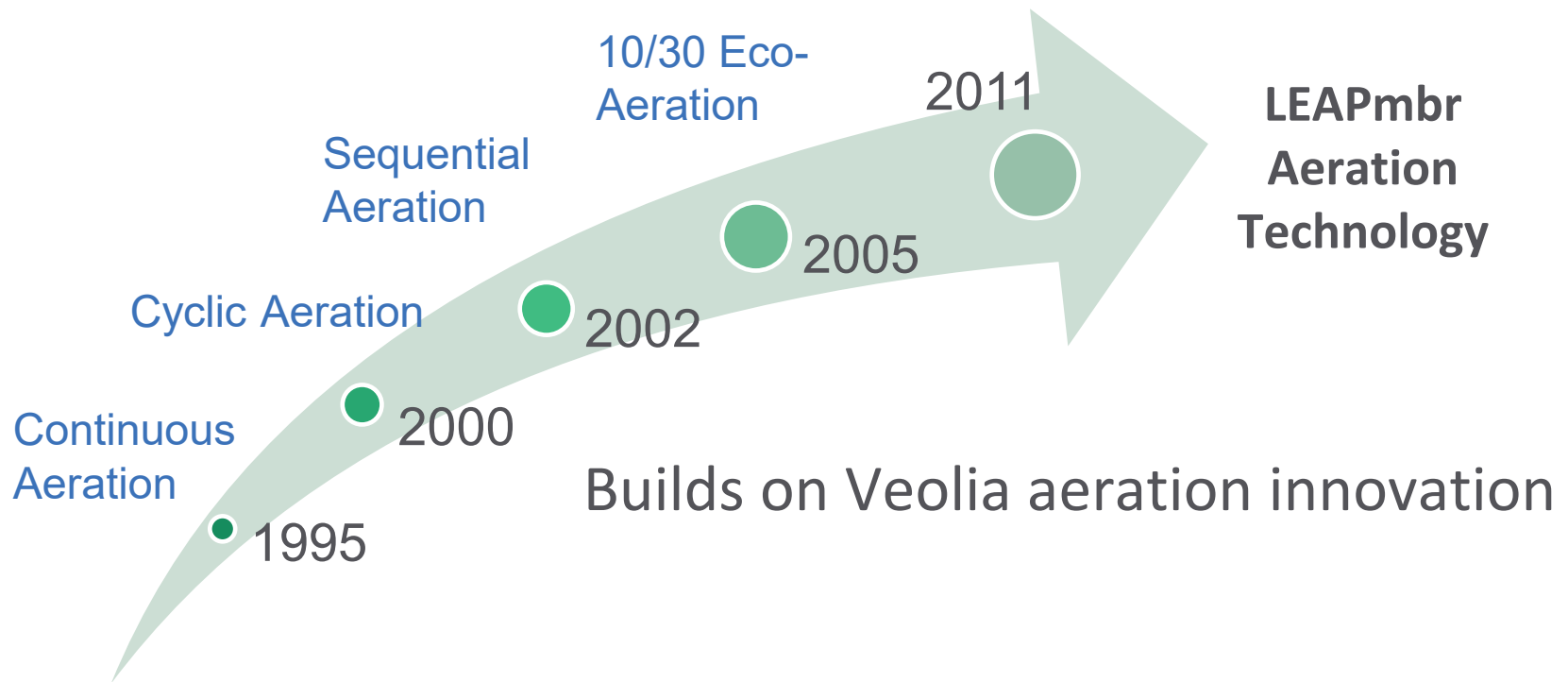




LEAPmbr



LEAPmbr Aeration Technology



What was LEAPmbr?

A new product introduction that combined three key features



Increased Packing Density for all ZW500 Products



Product Flux Optimization



LEAPmbr Aeration Technology

Plus two system design changes

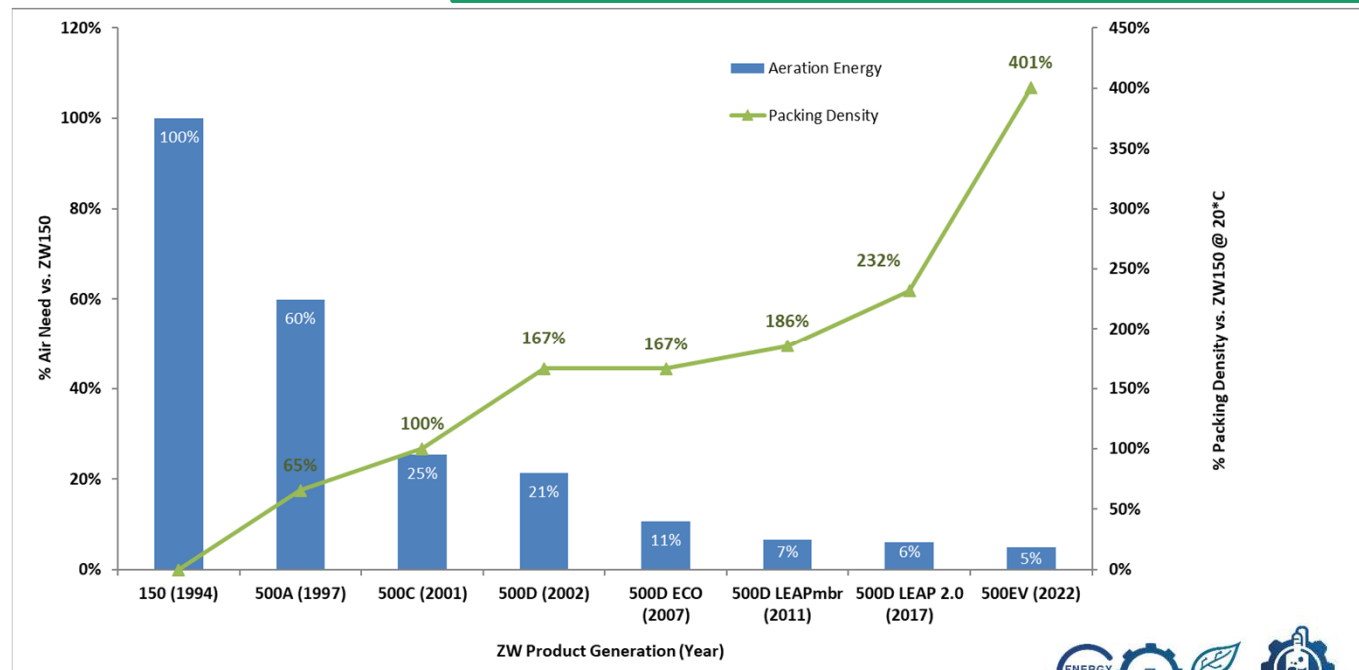


Reduced membrane tank liquid levels



Reduced Membrane Tank Width of 2.74 m (9 ft)

All ZW500 Products Include features of LEAPmbr today. Improvements made in highlighted areas.



LEAPmbr Aeration Technology

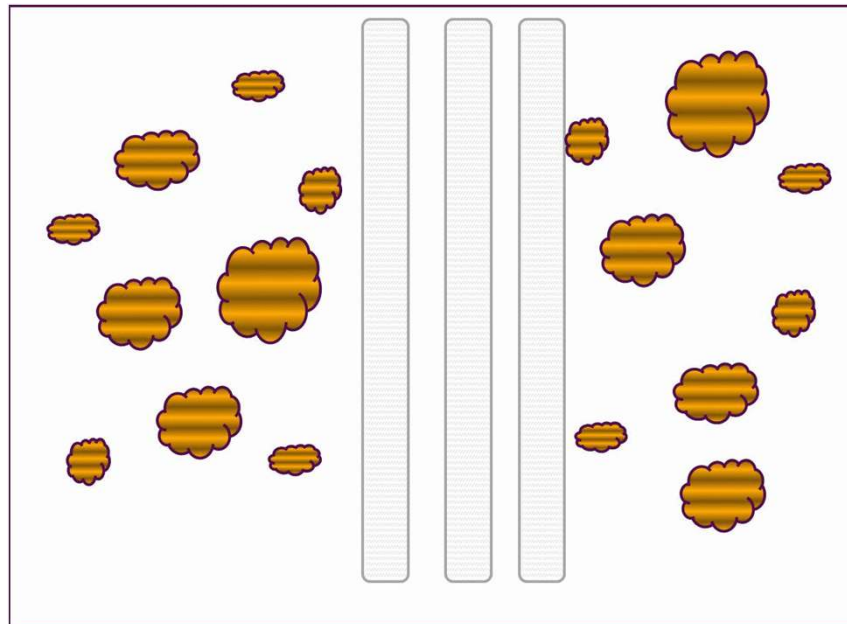
Focus on creating shear along membrane surface via:

- Bubble volume & shape
- Frequency of air release
- Location of air release

Larger bubbles delivered at shorter intervals create more shear and reduce fouling.

The effectiveness of the large bubbles results in less total air volume being required.

Why Bigger Bubbles are Better



LEAPmbr Aeration Technology



LEAPmbr Aeration



Sequential Aeration



Case Study



CASE STUDY – HENRIKSDAL MBR (STOCKHOLM, SWEDEN)

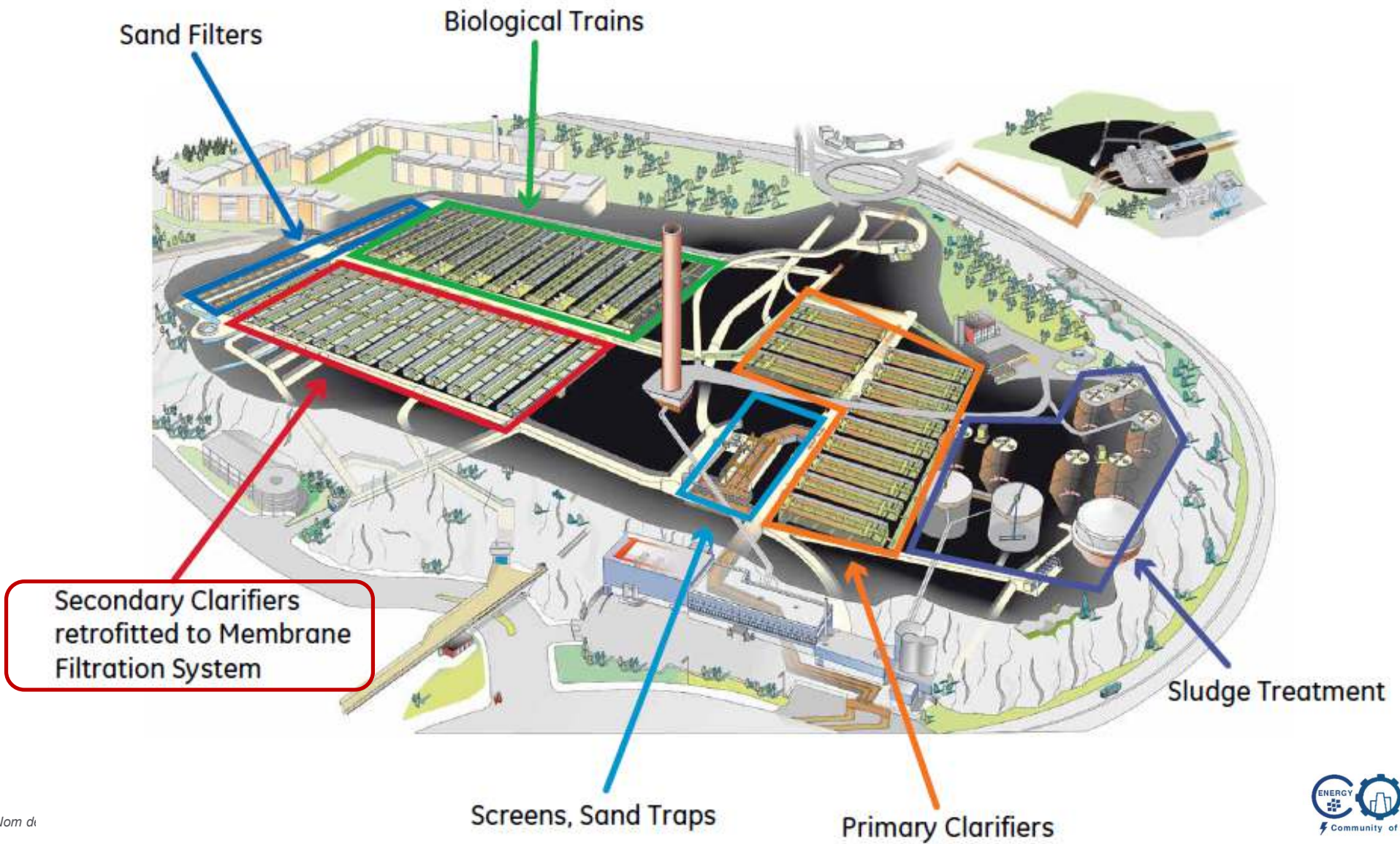
WWTP operated by Stockholm Vatten and serving 1.1 million population equivalent (PE).

Challenges,

- fastest growing city in Europe, 1.5% population growth annually
- existing conventional activated sludge treatment plant
- new stringent discharge requirement, to meet Baltic Sea Action Plan (BSAP) and EU Water Directive
- the need to increase treatment capacity with limited land in the city







CASE STUDY – HENRIKSDAL MBR (STOCKHOLM, SWEDEN)

Parameter	Influent	Effluent Requirement
Average Daily Flow	535,680 m ³ /day	-
Peak Flow	864,000 m ³ /day	-
Temperature	8 to 19° C	-
Suspended Solids	60,000 kg/day	2 mg/L Daily Avg.
BOD	58,000 kg/day	6 mg/L Quarterly Avg.
Total N	17,500 kg/day	6 mg/L Annual Avg.
Ammonia-N	-	2 mg/L Monthly Avg. (May to Oct)
Total Phosphorous	1,500 kg/day	0.2 mg/L Quarterly Average

