



Aqwise Drinking Water Solutions

A sustainable solution for drinking water treatment



Proprietary and Confidential

The need

Thousands of drinking water sources have been closed all over the world because of nitrate contamination. In USA alone, hundreds of drinking water wells were closed recently.

The problem of drinking water sources:

- Surface water – potential contamination from upstream sources (effluent, industrial discharges, polluted runoff) – **NO₃, NH₄, P, BOD**
- Ground water – potential contamination from surface sources (overuse of fertilizers in agriculture irrigation with effluent, wastewater – **NO₃, NH₄**)

The problem

- Common methods for drinking water treatment are based on separation
 - Membranes separation: RO and electro dialysis
 - Ion exchange
- Transfer of the pollution from a large to small concentrated stream – **the brine**
 - High disposal costs
 - cannot be discharged to the sea or the sewage system as it overload local waste water treatment plants (WWTP).
 - Not sustainable

The challenge

Developing effective, environmentally friendly and innovative technology without brine stream.

Using microorganisms for drinking water - ?

- Biological treatment for drinking water is successfully applied in Europe for many years, In the US biological treatment is the process of approval.
- Biological treatment is suitable both for direct treatment of the water source, and for treatment of concentrated brines
- Fixed-film systems have a distinct advantage over suspended growth systems (i.e., AS or MBR) due to ease of adaptation to low pollutant concentrations
- Separation after biological treatment using UF followed by disinfection ensures compliance with bacteriological requirements

Innovation that works: Aqwise Biomass Carriers

- Material: HDPE (virgin or recycled)
- Size: 12 mm
- Surface area (effective): 650 m²/m³ of carriers
- Geometry: Highly open external surface



The AGAR® Advantage

- 💧 Small footprint
 - 💧 Both for new applications and upgrades
- 💧 Cost Effective (CAPEX & OPEX)
 - 💧 Lower amount of civil works needed
 - 💧 Shorter project life cycle
 - 💧 Lower maintenance costs (operation - MBBR)
- 💧 Flexibility & Scalability
 - 💧 Upgrade existing plants easily
 - 💧 Enables gradual expansion – just-in-time investment
 - 💧 Deals with inflow peaks

The AGAR® Advantage (Cont.)

💧 Stability & Durability

- 💧 Improved resistance to hydraulic shock loads
- 💧 Shorter recovery time after toxic loads
- 💧 Extended carriers life time

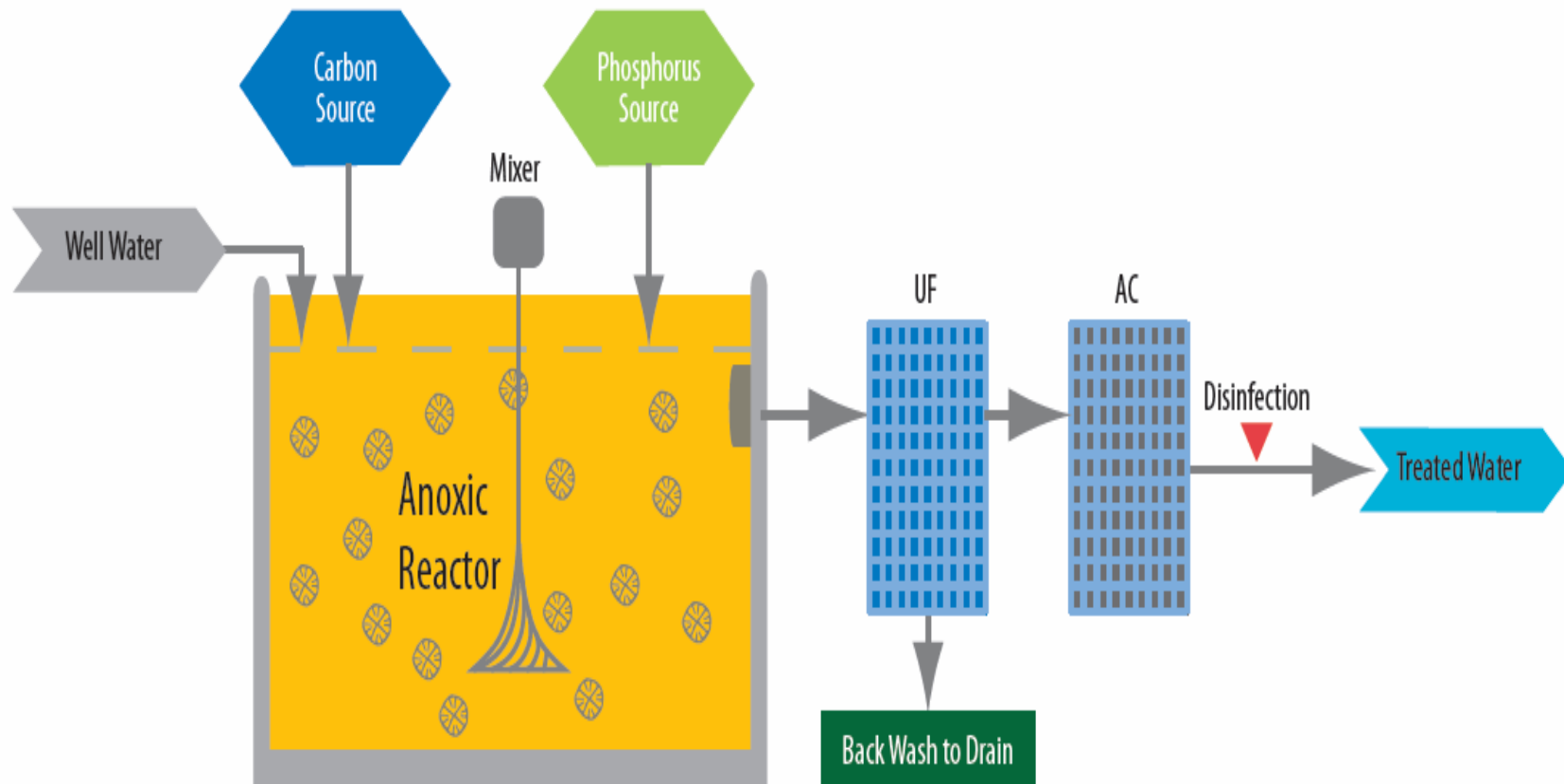
💧 Environmental Friendly

- 💧 Using recycled materials
- 💧 Less land usage, scenery obstruction and odors
- 💧 Less sludge

Denitrification of well-water

- **α test** at Aqwise R&D center
- **On site β pilot plant**, in cooperation with Mekorot (the Israeli water company) and in coordination with the Israeli Ministry of health. The pilot was operated for more than 6 months at a contaminated well containing 110 ppm of Nitrate. Some of the monitored parameters were:
 - ❖ Nitrate and (NO_3) Nitrite (NO_2)
 - ❖ Microbiology
 - ❖ Turbidity and organic matter.

Treatment configuration



Aqwise technology

- **Biological treatment took place in a mixed anoxic reactor** containing Aqwise biomass carriers where denitrification was performed, converting nitrate (NO_3) to Nitrogen gas (N_2) which is released to the atmosphere and doesn't have negative impacts on the environment.
- **Advanced filtration** by Ultra Filtration membrane – for suspended solids and biomass removal. The backwash drain can discharge to the sewage system as it contains only TSS (300-400 ppm) and biomass.
- **Activated carbon absorption** (optional) – for organic matter removal.
- **Disinfection** by chlorination

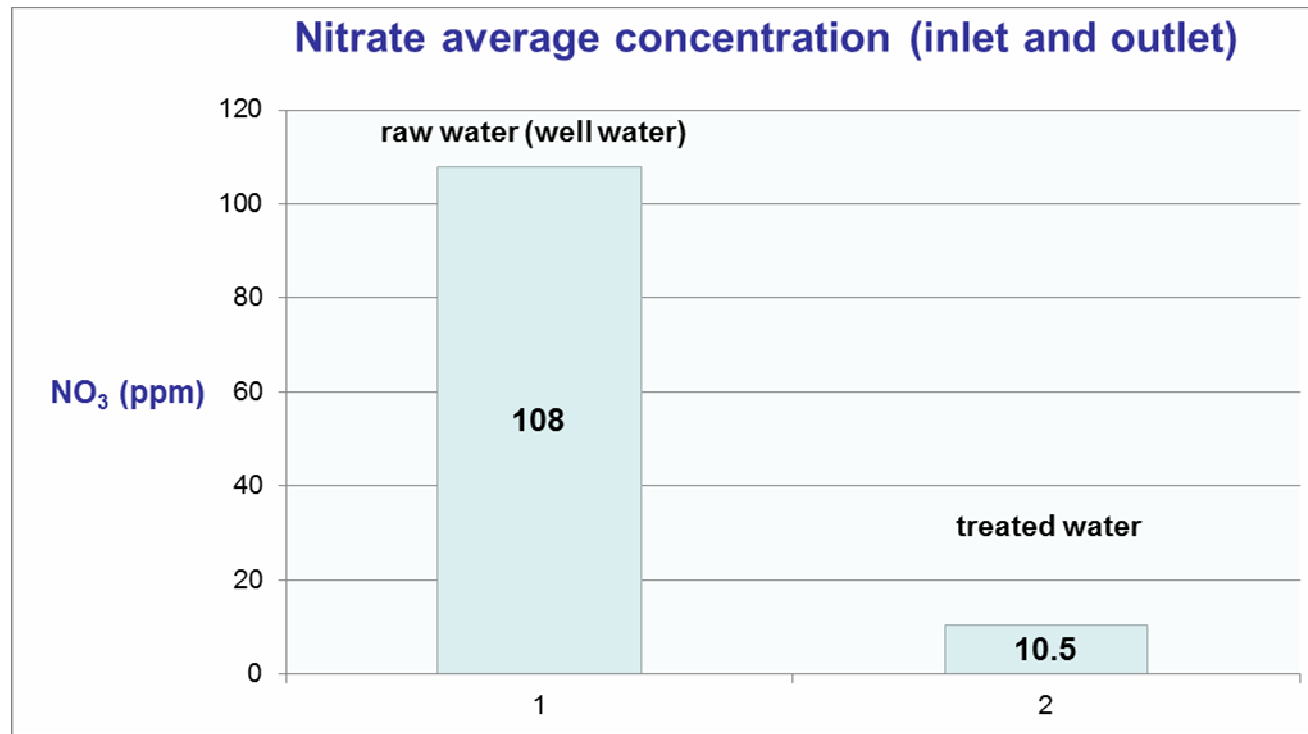
The results

The pilot plant was tested at different operational conditions which include short and long initiated shutdowns, on purpose to test the treatment process stability.

The results:

- ❖ Reliable and stable process.
- ❖ Drinking water standards (nitrate, nitrite, microbiology, turbidity)
- ❖ Cost effective system

Nitrate result



Microbiology results

The treated water quality stands within the Israeli drinking water regulations

	Total count [CFU/ml]	Total Coliform [CFU/100 ml]	Fecal Coliform [CFU/100 ml]	Strep. Fecalis [CFU/100m l]
Israeli regulation	<1000	<3	0	0
Pilot average result	240	ND*	ND*	ND*

ND- not detected

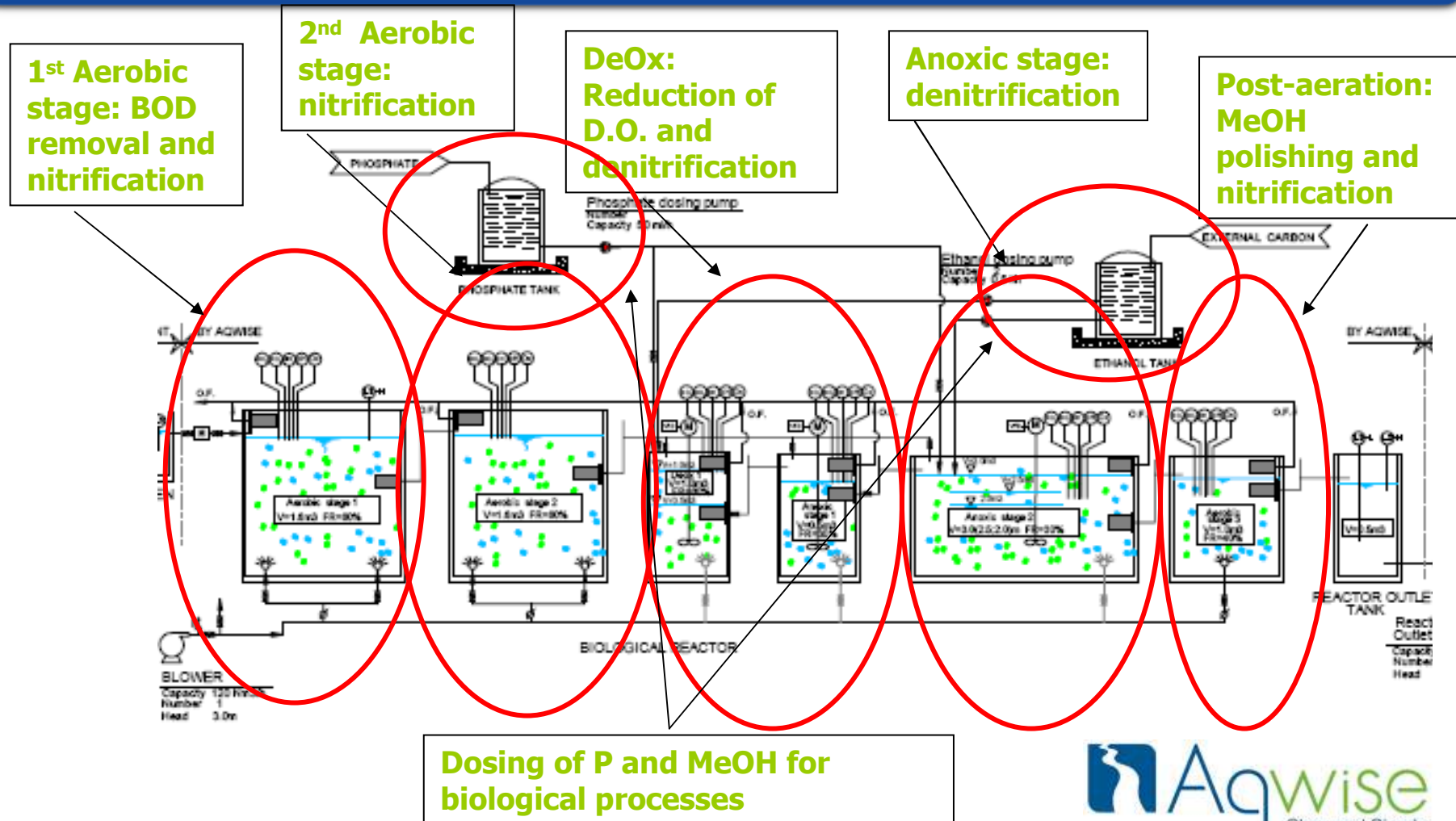
Treatment of Surface water

- Multiple MBBR configuration can deal with NH_4 , BOD and NO_3 biologically
- Low levels of pollutants treatable at very short HRTs - 1-2 hours
- Fixed-film adapts to low-levels of pollution with no negative effect on the treatment process

Yamuna River Water Treatment Plant, Agra, India

- 160,000 m³/d of river water to be treated for potable use
- Upstream WWTPs discharge to the river, resulting in lightly polluted water
- Biological treatment in MBBR followed by UF selected as the treatment process
- Plant currently under construction
- Pilot plant currently running on site

Process Flow diagram



Influent Characteristics

Parameter	Unit	Inlet to the proposed biological reactor	Comment
Design flow - total	m ³ /d	100	equalized-4.2 m ³ /h
Design Temperature	°C	15/28	
COD	mg/l	99	
BOD ₅	mg/l	33.8	
BOD ₅ soluble	mg/l	20.3	
TSS	mg/l	100	
Ammonia as NH ₃	mg/l	24.5	
Ammonia as N	mg/l	16.7	
Nitrate as NO ₃	mg/l	25.4	
Nitrate as N	mg/l	6.2	
Nitrite as NO ₂	mg/l	2.5	
Nitrite as N	mg/l	0.76	
TP	mg/l	1.0	
Oil and Grease	mg/l	< 40	Required by Aqwise
pH		6 – 8	Required by Aqwise

Effluent Requirements

Parameters	Units	After MBBR
Ammonia (as NH ₃)	mg/l	2
Ammonia as N	mg/l	1.6
Nitrate (as NO ₃)	mg/l	40
Nitrate as N	mg/l	9.0
BOD ₅ soluble	mg/l	2
TSS	mg/l	114

Biomass Carriers – Aerobic zone



Biomass Carriers – DeOx zone



Biomass Carriers – Anoxic zone



Pilot Plant Results – NH₄

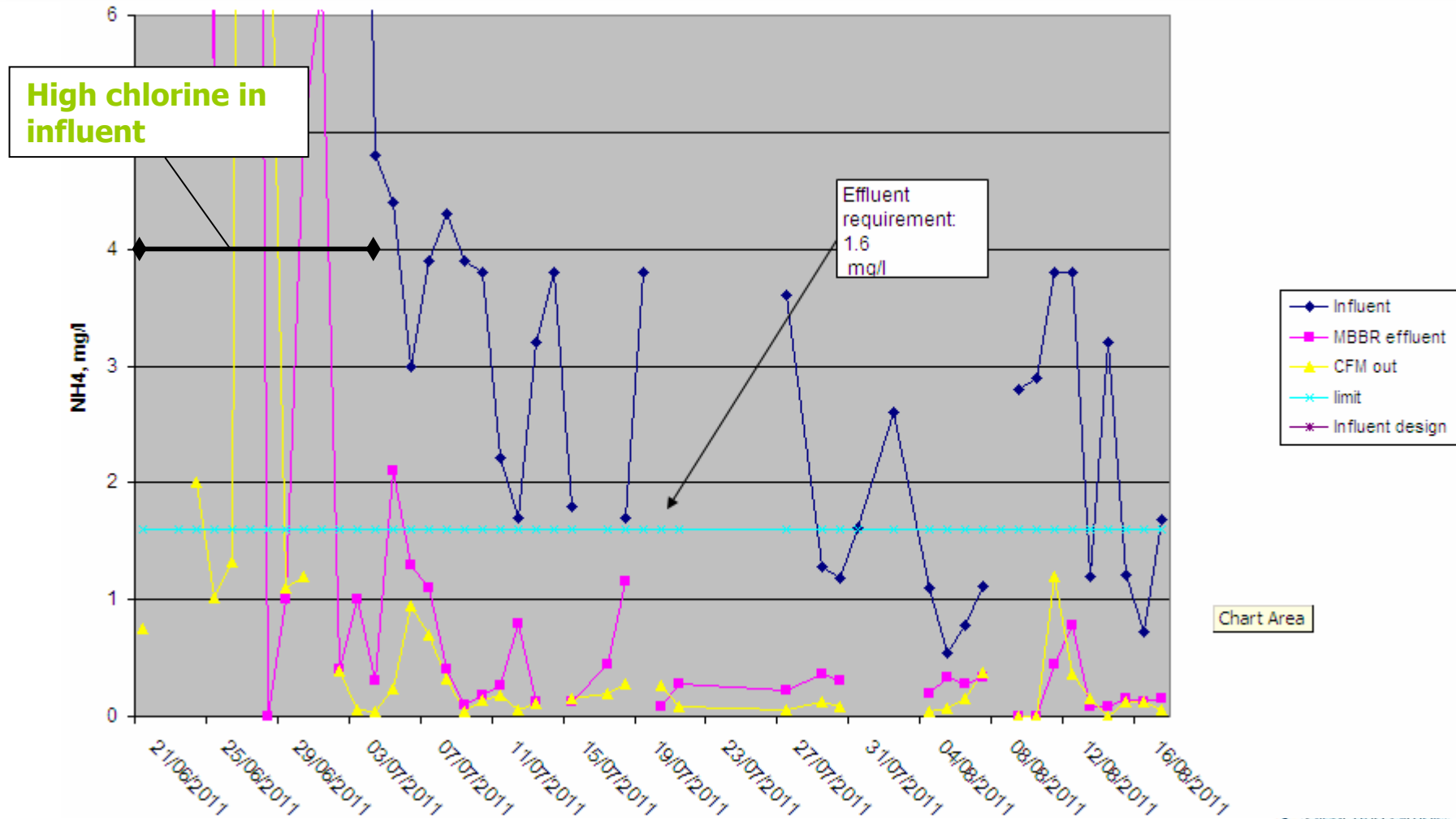
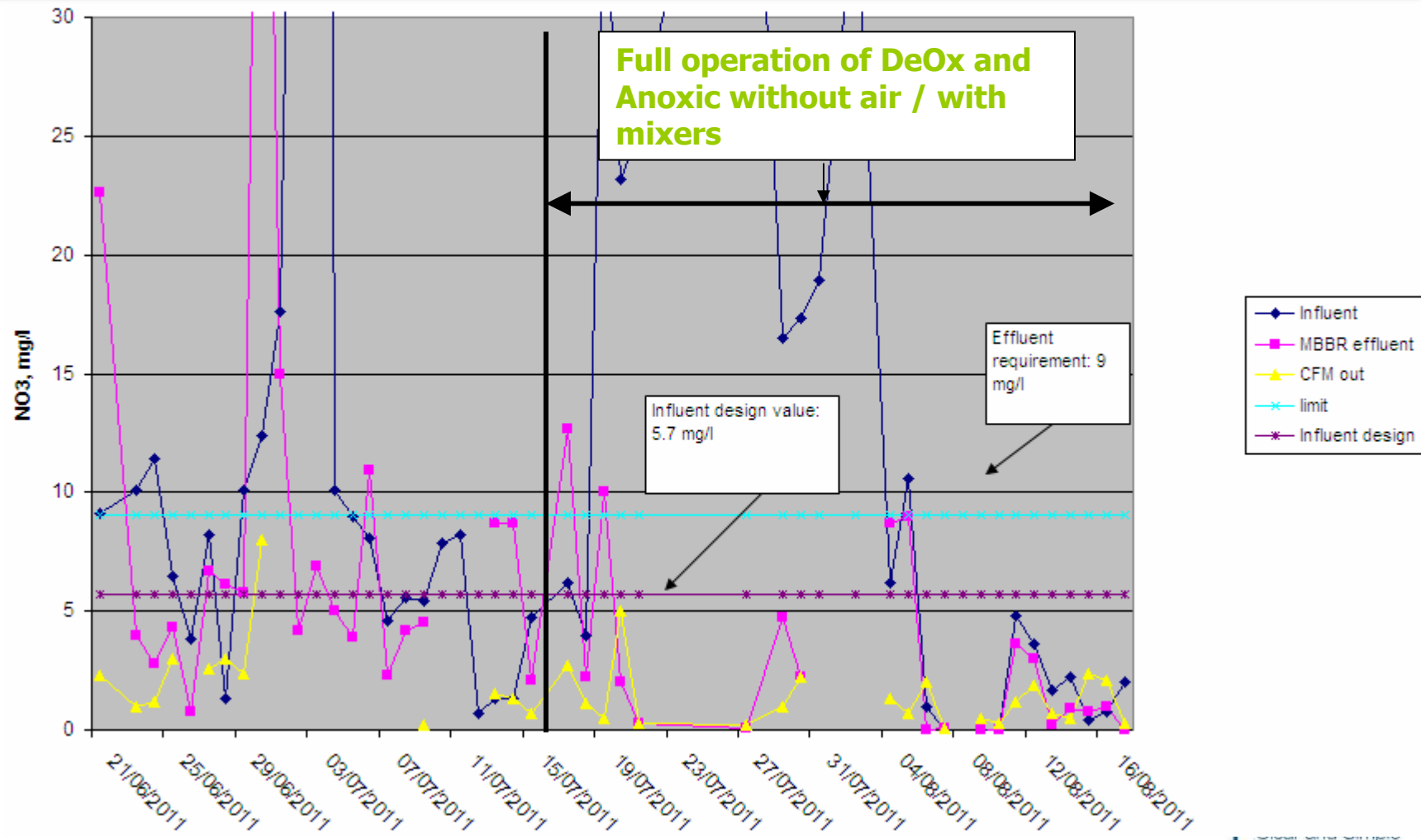
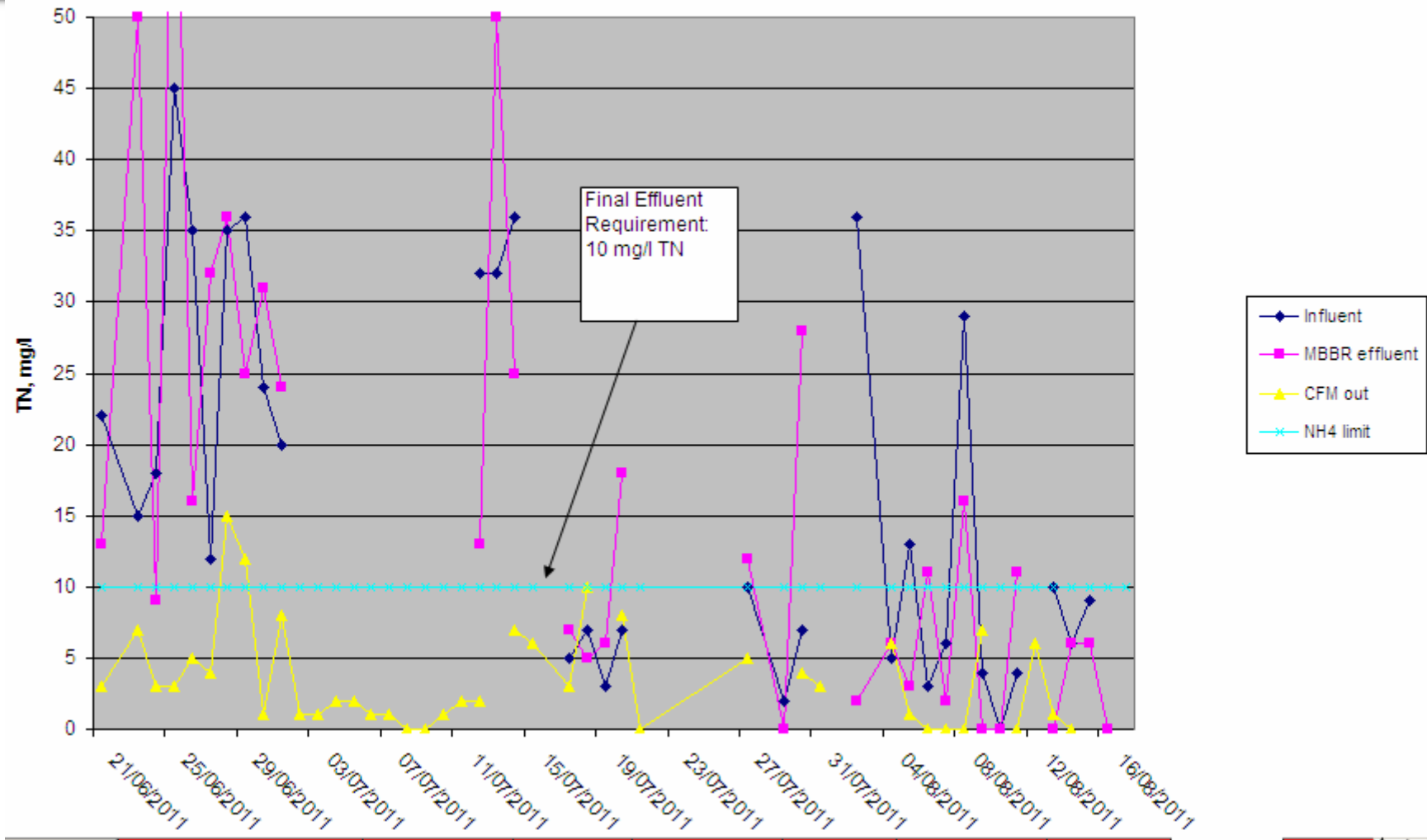


Chart Area

Pilot Plant Results – NO₃



Results – Total Nitrogen



The Next Step...

- Biological treatment of brines from existing RO systems being piloted
- Implementation will allow on-site treatment of brines in existing potable-water drinking plants

Aqwise technology advantages

- **Innovative technology** - The unique Aqwise biomass carriers enables effective treatment process with short retention time (HRT) and therefore enable small footprint.
- **Operational advantages over other biological treatments** such as channeling and clogging in the anoxic reactor.
- low energy demand - 0.2 KW/hr compared to 0.7 KW/hr in RO.
- **High recovery rate** – more than 95%
- **Environmentally friendly solution** - without concentrated brine which is costly and complicated to handle.
- **Cost effective solution**



Thank you!