



A Novel Biotechnology for Treatment of Nitrate in Water

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Outline

- About Microvi
- A Novel Biotechnology for Nitrate Treatment
- Example Installations /Case Studies
- Q & A





About Microvi

- California-based company started in 2008 and currently commercializing its **clean and sustainable technologies**
- **Transformative** technologies for the treatment of **a wide range of pollutants** in water and wastewater as well fermentation processes
- We are currently partnering with **Sunny Slope Water Company** to conduct challenge testing for conditional acceptance of our product by CDPH for drinking water treatment. We anticipate beginning this testing in **September 2013**.





A Novel Biotechnology for Nitrate Treatment

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Unresolved Issues with Conventional Technologies

Evolutionary Technologies

Biological

- Unreliable microbial activity
- Microorganism loss
- Sludge production
- Large footprint

Physical

e.g. Nanofiltration

- Secondary waste streams
- N/A for all contaminants
- High energy usage
- Large footprint

Chemical

e.g. Ion Exchange

- Expensive consumables
- Secondary waste streams
- N/A for all contaminants
- Post treatment needed

Membrane Bioreactor

- Frequent fouling (short lifespan)
- Sludge production
- N/A for all contaminants

← HIGH LIFECYCLE COST →



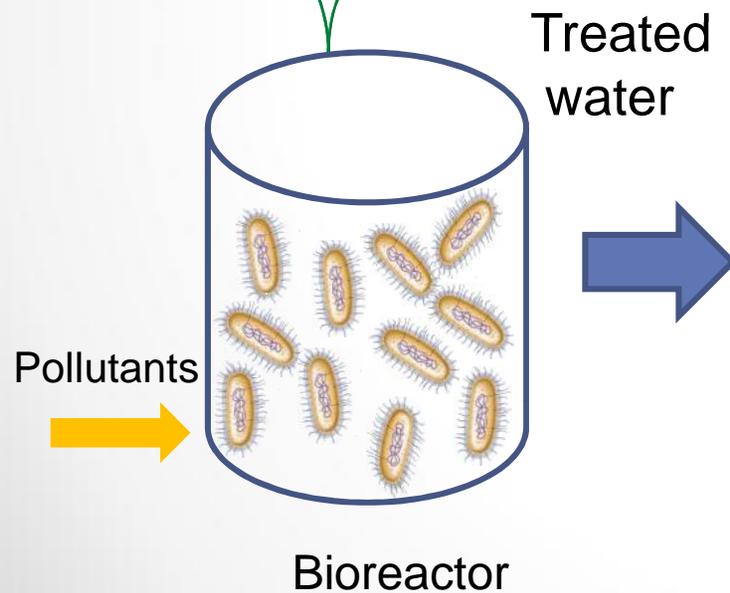
Biological treatments today is plagued with costly problems



Gram - Bacteria



Gram + Bacteria

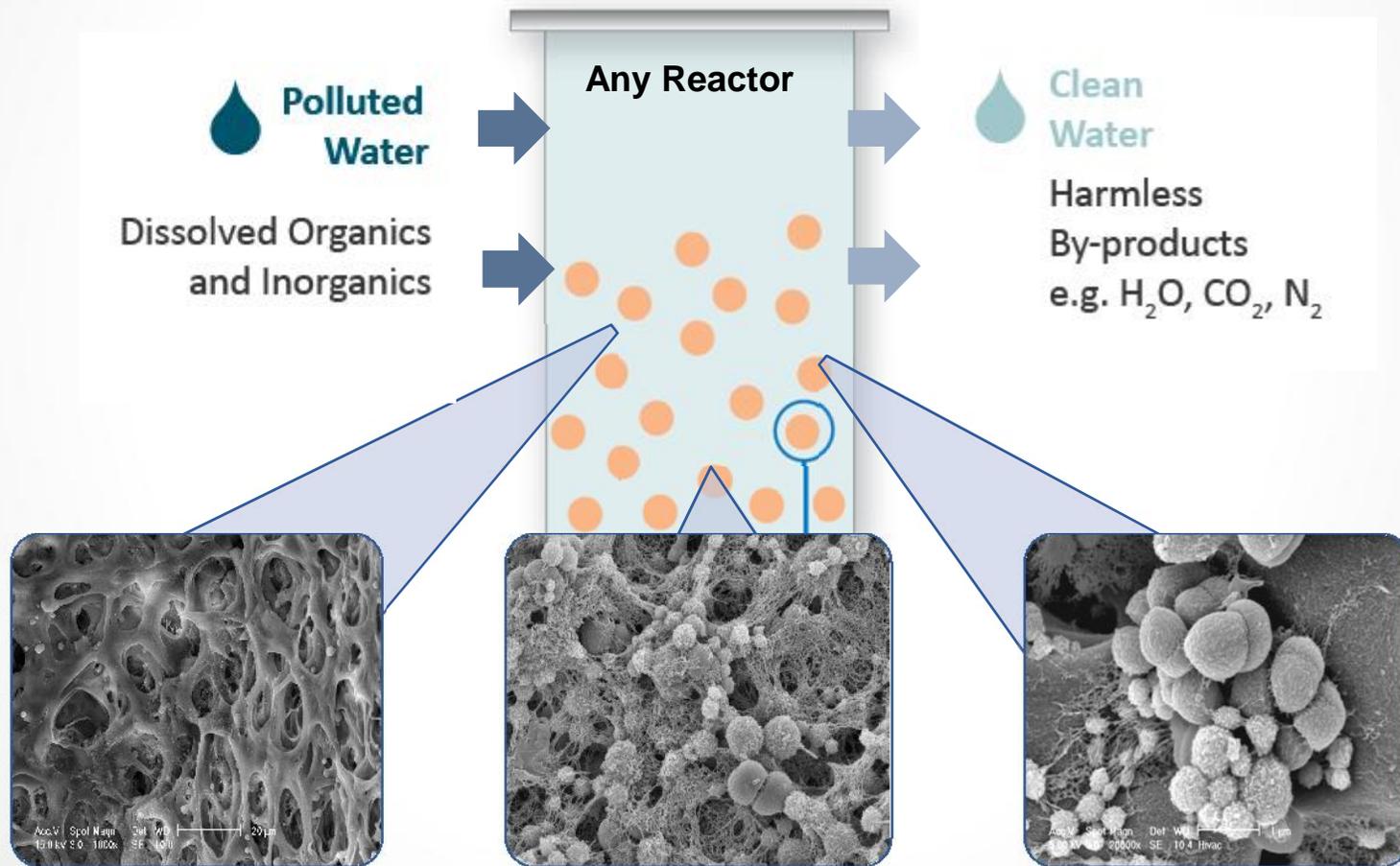


- Unnatural environment
- High rate of fatality
- No protection against toxicity
- High risks of contamination
- Low cell density
- Low reaction rate

High Costs

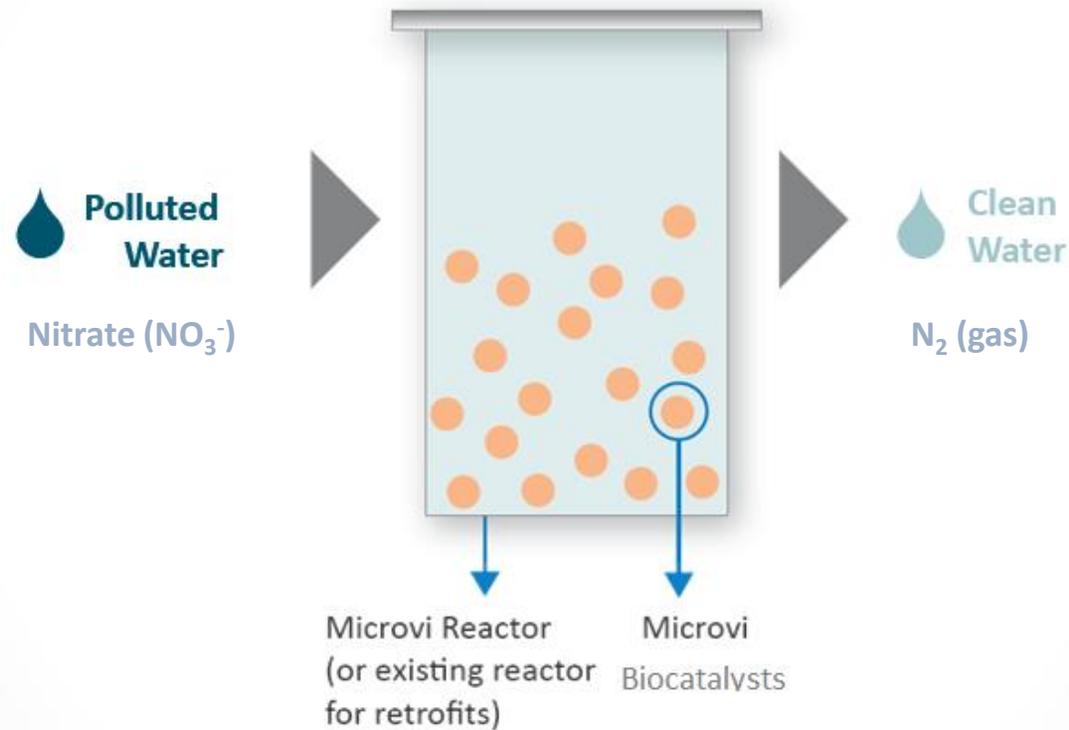
MicroNiche Engineering Technology

We design and engineer ideal microenvironment for the pollutant degrading organisms in 100's different applications





How Does the MB-N₂TM Technology Work?





Proven results for water treatment

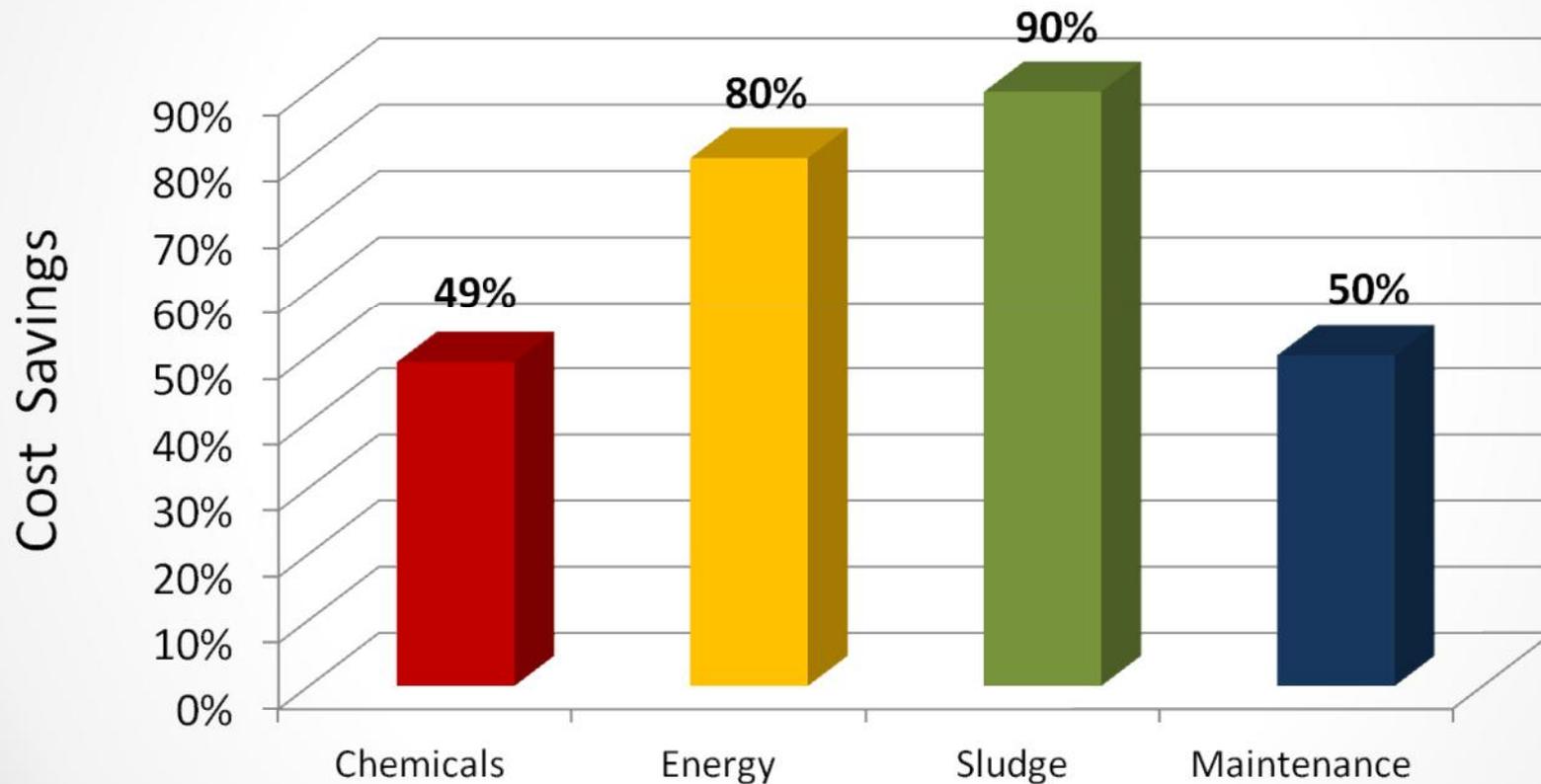
Key Parameters	Microvi
Start up	Extremely rapid
Sludge & Secondary Waste	Essentially eliminated
Footprint	Small
Down time	Essentially eliminated
Post and solid treatment	Eliminated or minimized
Reactor size	Small
HRT	Low
Removal Efficiency	High
Toxicity tolerance	Very high
Fouling and clogging	Eliminated or minimized
Stability and control	Very stable and controlled p

Disruptive
in every
direction





Disruptive technology in every direction for water treatments



Microvi Customer : 7 MGD Water Treatment Plant Retrofit
(50 % Reduction in OPEX)



Microvi's Transformative HRTs

MB Technologies	Source Water	COCs	HRT (min) conventional bioprocess	HRT (min) Microvi	Faster
MB-P	GW	Perchlorate	14	< 0.5	28 X
MB-N2	WW, GW	Nitrate	> 120	< 5	24 X
MB-N1	WW	Ammonia	> 360	<60	6 X
MB-CS	WW	Solvents	> 360	<10	36 X
MB-CP	WW	Phenols	> 480	<24	20 X
MB-HAB	WW	BTEX, Alcohol	> 480	30	16 X
MB-TO	SW	MIB & Geosmin	NA	30	NA
MB-DX	GW	Dioxane	NA	30	NA
MB-WWT	WW	BOD/COD	>1400	360	4X



MB-N2 Technology Performance

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Case Study – Nitrate Removal

Drinking Water for Remote Communities in Australia

BACKGROUND: Aboriginal communities drinking water had nitrate levels over 100ppm with flow rate of 75 gpm, no conventional technology effective

SYSTEM DESIGN

Application: Nitrate removal drinking water

Location: Western Australia

Type: Permanent Installation

HRT: 10 minutes

Biocatalyst: MB-N2

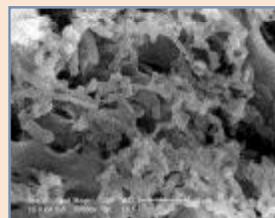
Influent: 100 ppm NO_3^-

Effluent: 25 ppm NO_3^-

RESULTS

- 1st biological system to obtain the Australian Water Quality Certification for drinking water
- 40% cost savings over conventional alternative (RO & Ion Exchange)
- (2) commercial units designed and installed by a third party following a successful pilot demonstration

MB-N2 SYSTEM





Case Study – Nitrate Removal

Municipal Drinking Water Small Pilot

BACKGROUND: 4 MGD drinking water plant impacted by nitrate at 45 ppm and TOC 17 ppm

SYSTEM DESIGN

Application: Nitrate removal drinking water

Location: California, USA

Type: Pilot Demonstration

Duration: 120 days

HRT: <10 minutes

Biocatalyst: MB-N2

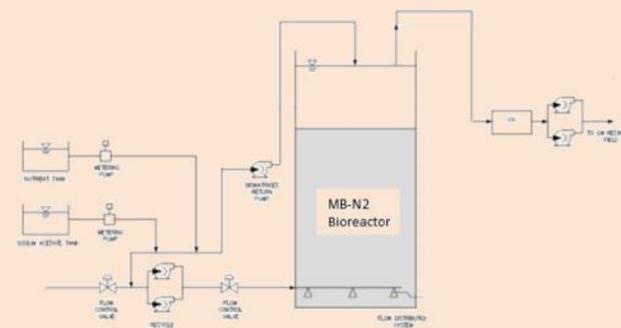
Influent: 40 ppm NO_3^-

Effluent: <2 ppm NO_3^-

RESULTS

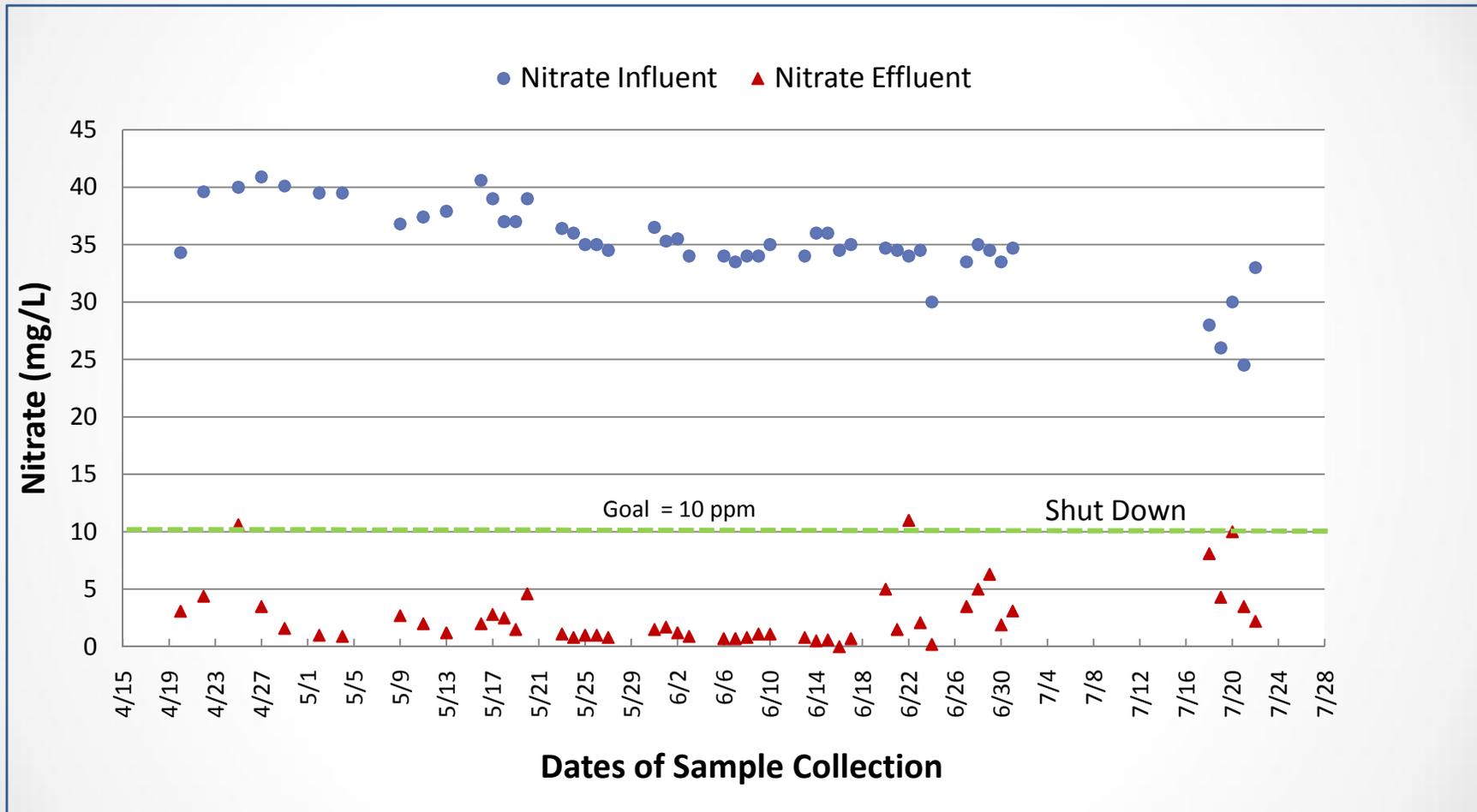
- Nitrate reduced from 40ppm to below 10ppm
- TOC also reduced from 17ppm to 4ppm
- No waste stream
- Easy to operate and adaptable to various operating conditions
- Awarded 10 year Design, Build, Own, Operate Contract pending CDPH Acceptance

MB-N2 SYSTEM



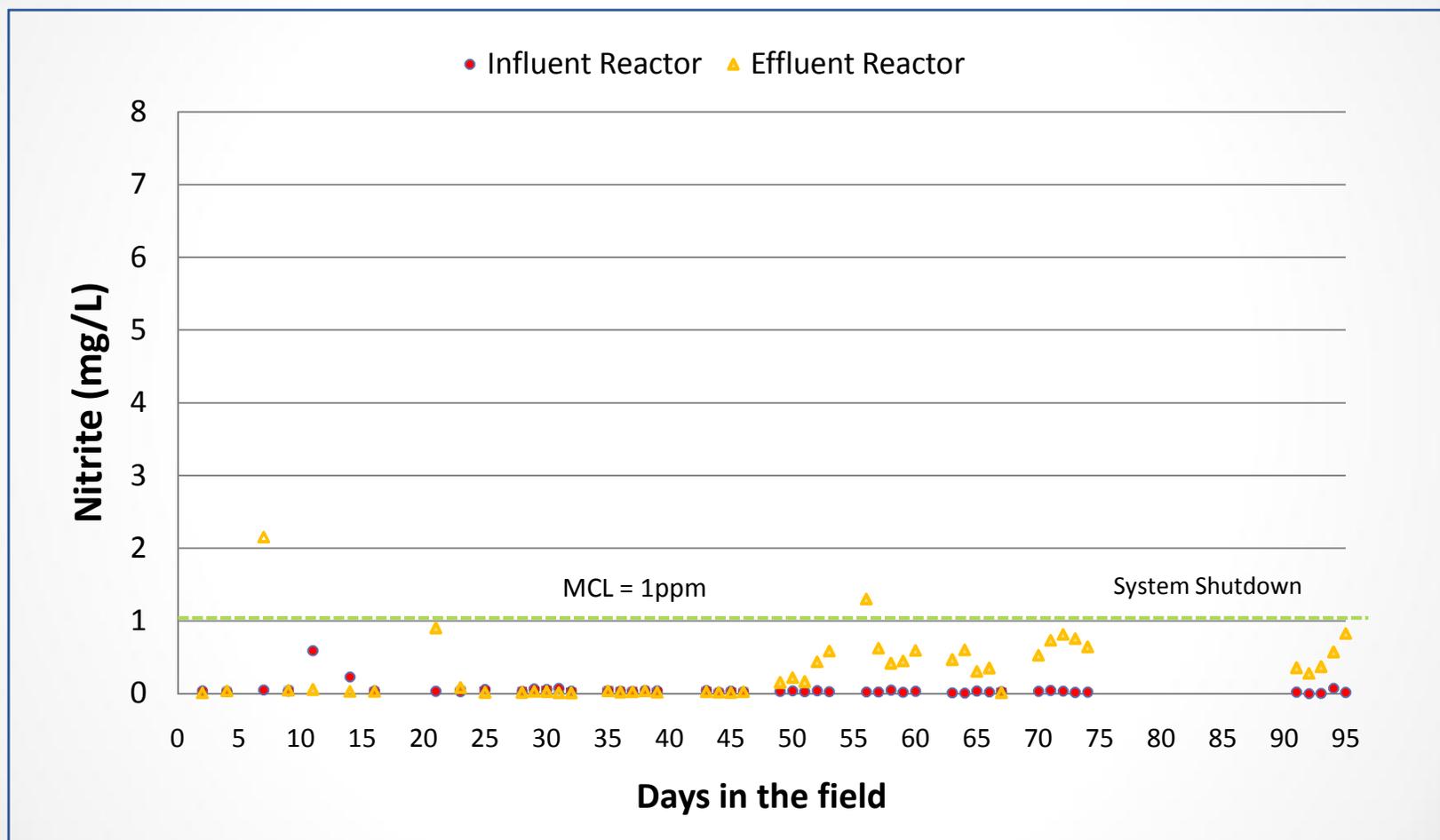


Nitrate Reduction HRT=10 min





Nitrite profile





Large Scale Installation, CA

175,000 GPD

BACKGROUND: Successful demonstration at pilot led to a large scale demonstration

MB-P SYSTEM

Application: Nitrate and Perchlorate Removal – Non Potable Water

Location:
California, US

Type: Large Demonstration

HRT: <10 minutes

Biocatalyst: MB-N2

Influent: 10 ppm NO_3^-

Effluent: <1 ppm NO_3^-

SYSTEM DESIGN





Nitrate Treatment Cost Estimate

Date	9/4/13
Client	Rural Communities
Project	Nitrate Groundwater

Design Parameters

Flow rate	gpm	50
Nitrate Influent	mg/L	60
Nitrate Effluent	mg/L	2
% Reduction Required	%	97%
Hydraulic Retention Time	min	12

Capital Cost (+/- 30%)

Design, Equipment, Instruments

Treatment System Cost (Installed)	\$	180,000
Initial Biocatalyst Cost	\$	40,000
Total Capital Cost	\$	220,000
Capital Cost	\$/yr	11,000

O & M Cost (+/- 30%)

Labor, Maintenance
60 mg/L Nitrate Reduction
Config serv, warranty & media replace

Maintenance	\$	5,000
Chemicals	\$	8,000
Annualized Media Cost (5 yr Replacement)	\$	8,000
Total O&M Cost	\$	21,000

Total Cost

Capital Cost	\$/acre foot	136
Operating Cost	\$/acre foot	260
Total Annualized	\$/acre foot	397

Years	20
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Capital Cost	\$/1000 Gal	0.42
Operating Cost	\$/1000 Gal	0.80
Total Cost	\$/1000 Gal	1.22

*May require treated water storage tank to meet demand.



A
simple
yet elegant SOLUTION for
water treatment



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