nanostone

CUF|Shield™ CUF|ShieldPlus™ In Industrial Wastewater Treatment

July 2025

ACURIANT
Life's Essentials. Performance Solutions.

You've got plenty on your plate. Why this hour matters.

You might be wondering if this session will be worth your time. You've got capital planning, compliance risks, system headaches, and a dozen vendors claiming to have the answer. We understand.

Here's what you get from this hour with us:

- A straight-shooting view of what works—and what doesn't—in operating fabs
- Lessons from **100+ pilots and 160+ references** across Asia, EU, and the US
- A clear, technically sound path to higher recovery and fewer headaches

We'll show you how to reclaim more, risk less, and get more done with less space.

Where others struggle, we thrive

Nanostone Ceramic UF is purpose-built for the extremes of industrial wastewater:

✅ Handles high turbidity (up to 12,000 NTU*) and TSS (up to 1,500 mg/L*)

✅ Tolerates aggressive chemistry and cleaning (up to 45°C, no pore shrinkage)

✅ Reduces downtime through faster, stronger backwash and no need for clarifiers

- **85%+ recovery** in streams where polymerics fail
- **Up to 2x longer lifespan** vs. hollow fiber systems
- **Minimal pretreatment**. Smaller footprint. More recovery.

✅ Delivers superior CUF Permeate for downstream processes (RO / SWRO / DI /EDI) Cooling Towers etc

- **SDI < 2.5 are typically achieved** as compared to 2-4 from Polymeric Hollow Fiber Membranes
- **Turbidity < 0.5 NTU**
- **Reducing Power Consumption** for downstream RO or SWRO membranes

*In semiconductor WWT applications

Overview & Global Footprint

A foundation for growth, built over a decade of investment, passion and focused strategy execution

- 160+ Employees
- Patented Ceramic Technology
- Global / Local Applications Engineering

- 160+ Operating Plants
- Drinking Water Approval NSF, UK Reg 31, MOH…
- 100+ Pilots/Field Demonstrations

2012 — Product development & validation

True North Venture Partners Acquires & Launches **Nanostone Water**

Water *(Drinking)* **Certifications** NSF, UL,MOH

2015 — Pilots/Demos

Commercial launch: Micro-electronics, Boiler feed Water, Drinking water

2017 — Commercialisation & global expansion

150+ Commercial Installations
Globally Validating Sweet Spot
Challenging Water - Maximising Limited Space

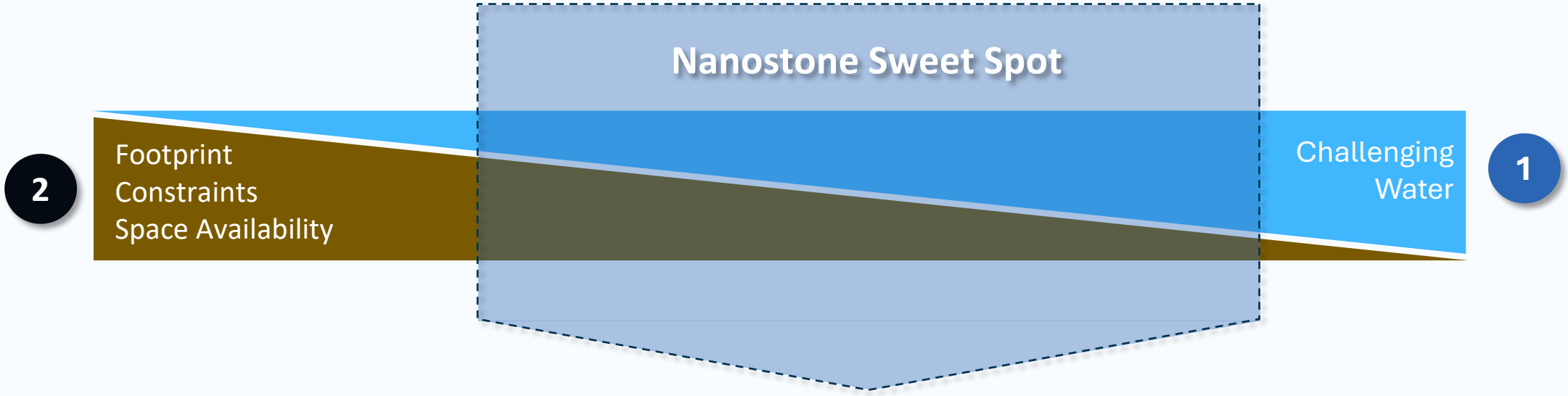
2024 — Accelerated growth

Successful **Equity Raise $30M** by Existing Investors

Launch of **Nanostone Solutions**

Defining the Sweet Spot for Nanostone Ceramic Technology

For both Municipal, Industrial & SWRO Water & Wastewater Applications



Typical challenges:

- Footprint constraints
- Capacity increase required
- Retrofits
- Flexible design
- Lower downtime required

- Variability in feed water quality
- Algal bloom/red tide events
- Higher fouling of downstream RO
- Frequent UF module replacement

Water Envelope

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No.	Parameter	Unit	CUF Range (Note-1)	CUF Range (Note-2)	Feedwater
1	Temperature	°C	1°C to 45°C	1°C to 45°C	
2	pH (Cleaning Range)	No.	2 to 12	2 to 12	
3	pH (Operating Range)	No.	4 to 9	4 to 9	
4	Turbidity	NTU	< 12,000	< 500	
5	Total Suspended Solids (TSS)	mg/L	< 1,200	<500	
6	Total Organic Carbon (TOC)	mg/L	< 10	< 10	
7	Dissolved Iron (Fe)	mg/L	<0.05	<0.05	
8	Dissolved Manganese (Mn)	mg/L	<0.03	<0.03	
9	Oil & Grease	mg/L	< 5.0	< 5.0	
10	Dissolved Silica (SiO_2)*	mg/L	< 200	< 200	
11	Particulate Silica (SiO_2)*	mg/L	< 200	< 200	
12	Conductivity	µS/cm	<80,000	<80,000	
13	Total Hardness as $CACO_3$	mg/L	< 200		
14	Chemical Oxygen Demand (COD)	mg/L	< 200	< 200	
15	Biological Oxygen Demand	mg/L	<50	<50	
16	Fluoride (F)	mg/lL	< 10		
17	Algae	cells/ml	<50,000	<50,000	
*	Silica can polymerize and cause fouling				
Note-1	Applicable for semi-conductor wastewater only.				
Note-2	Applicable for non semi-conductor wastewater.				
Influent Flow Rate Required					
Permeate Flow Rate Required					

High Solids Tolerance + Filtration Efficiency

Nanostone CUF works where others fail

Longevity & Durability

Lowers OPEX and makes operations easier

Sustainability & Environmental Compliance

Recycle more water with less chemicals and achieve ZLD

Compact Footprint & Highly Scalable

Increase capacity without real estate or increase use of constrained space

Resilience in Harsh Conditions

Your visual work deserves to get discovered.

Polymer Avoidance with CUF: the 30 nm ceramic pore size is so tight and uniform that polymers can quickly block the surface, forming a dense fouling layer that resists standard backwash and mild cleaning—often requiring aggressive CIP and increasing OPEX.

Customer first — the Acuriant Commitment

Customer-centric system design
We don't force-fit solutions. Every system is engineered based on detailed feed water envelope analysis to ensure membrane performance is optimized from day one.

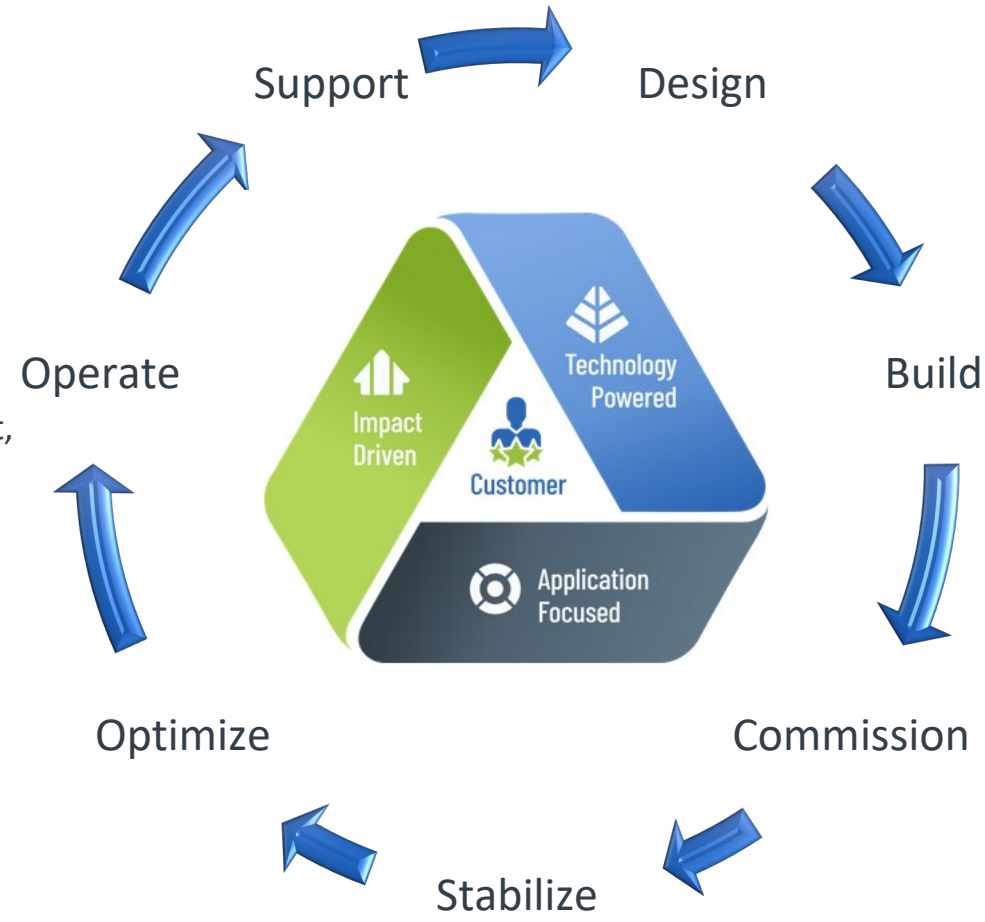
Expert on-site support
Our Process Applications Engineers are hands-on during commissioning and early operations—ensuring seamless startup, knowledge transfer, and rapid issue identification.

Proactive issue resolution
We don't wait for failure. Membrane autopsies and performance diagnostics help us detect, understand, and prevent issues before they escalate.

Structured root cause analysis (RCA)
When challenges arise, we lead a structured RCA to identify causes, share insights, and implement corrective actions based on real data.

Built for long-term reliability
Every design decision is made to maximize uptime, cleaning efficiency, and permeate quality—supporting sustained reclaim performance.

Rapid response and global service
Our support teams respond fast. Whether remote or on-site, we keep fabs running with minimal disruption.



Tackling Challenging Water | Maximizing Limited Space

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Pre-treatment – Minimized or Eliminated

- Lower OPEX
- Reduced footprint
- Simple operation

Robust performance

- Consistent product water quality of < 0.1 NTU / < 2.5 SDI
- No fiber breakage – no stoppage of the plant for maintenance
- Cleaning pH and chemical tolerance range: 2 – 12
- Wide operating temperature: 1 - 45°C / 33 - 113°F

Recovery: 80 – 95% in Semiconductor Reclaim Systems – Dead End Filtration

- Eliminates traditional crossflow operation, reducing the need for high-velocity circulation
- Replaced with alternating feed direction after each backwash and reverse feed flush
- Significantly lowers power consumption and overall energy costs
- Enables higher system recovery without compromising performance
- Enhances foulant removal and balances membrane loading across modules
- Simplifies system design and reduces OPEX while maintaining stable long-term operation

Typical Operating Flux: 100 – 180 LMH

Extended Life in Challenging Water – We measure module life in Years not Months

Traditional Surface Water or WW | Maximizing Limited Space

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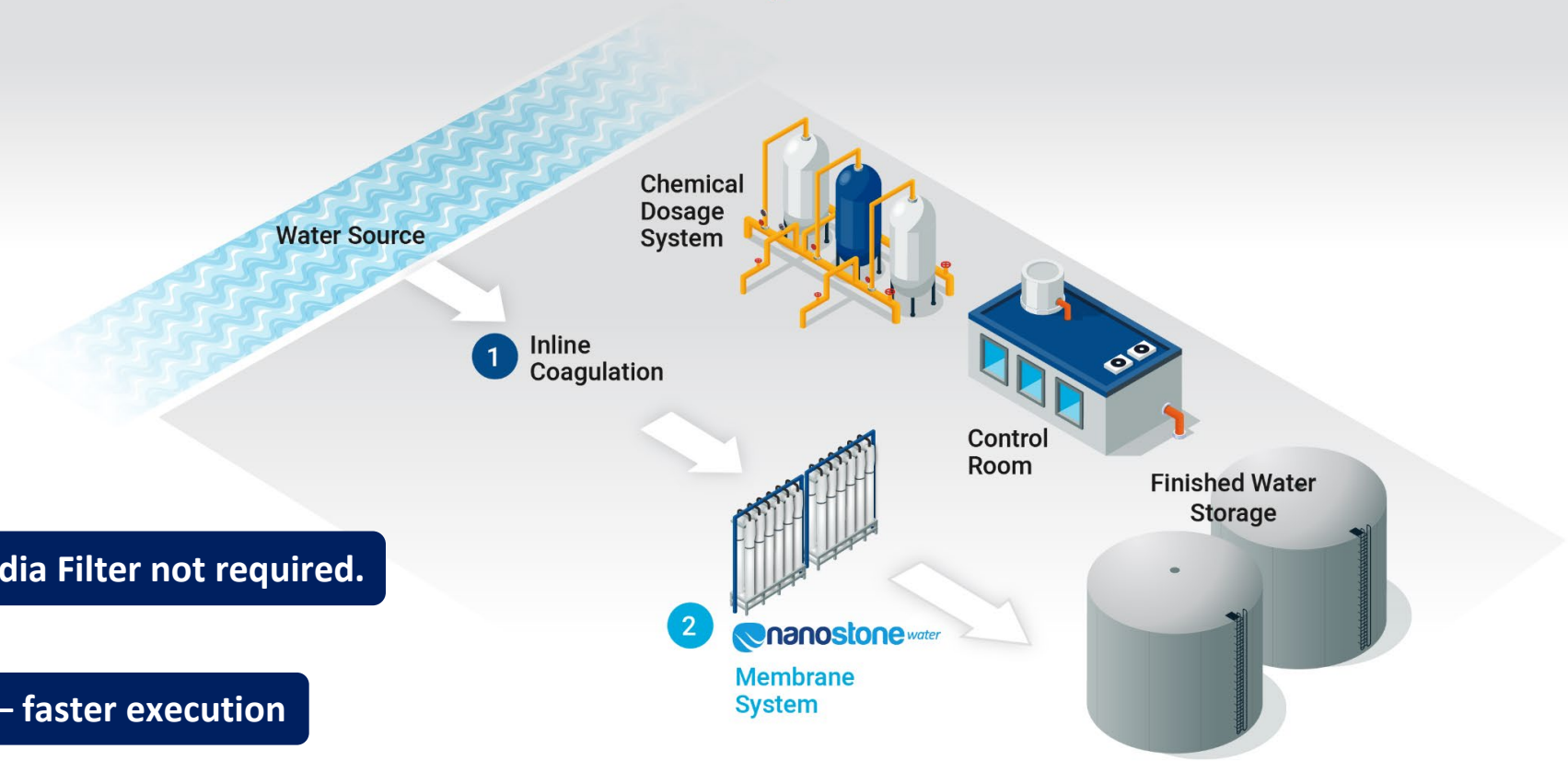
Streamlined Process



Clarifier / DAF / Media Filter not required.

Reduced civil work – faster execution

Handles variation in feed water quality very effectively

Sea Water Reverse Osmosis | Maximizing Limited Space

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Streamlined Process by Nanostone

Filtered water pump / Cartridge filter not required

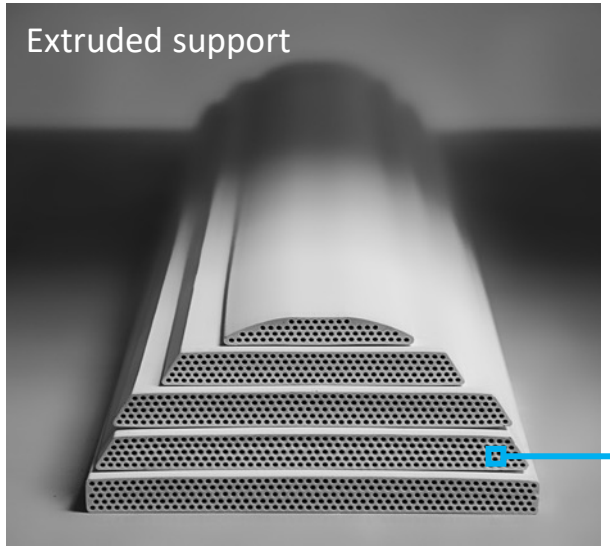
Higher Recovery – lower intake capacity

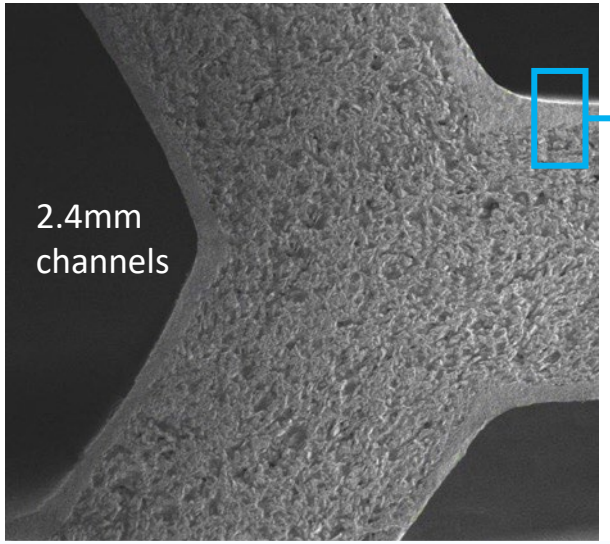
SDI<2.5 to reduce fouling of SWRO membranes

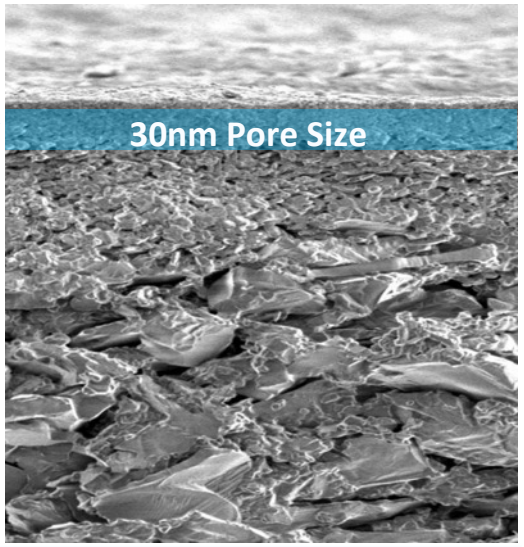
Handles Algal Bloom effectively

Clarifier / DAF / Media Filter not required.

Our Ceramic Ultra Filtration Technology







Segmented Design

- ✓ High Surface Area
- ✓ High Manufacturing Yield (no machining required)
- ✓ Low-Cost Manufacturing
- ✓ Pressure Vessel Designed to Simplify Retrofit
- ✓ Ceramic Extruded Support
  - ✓ Inorganic Construction
  - ✓ Greater Physical Strength
  - ✓ Abrasion Resistant

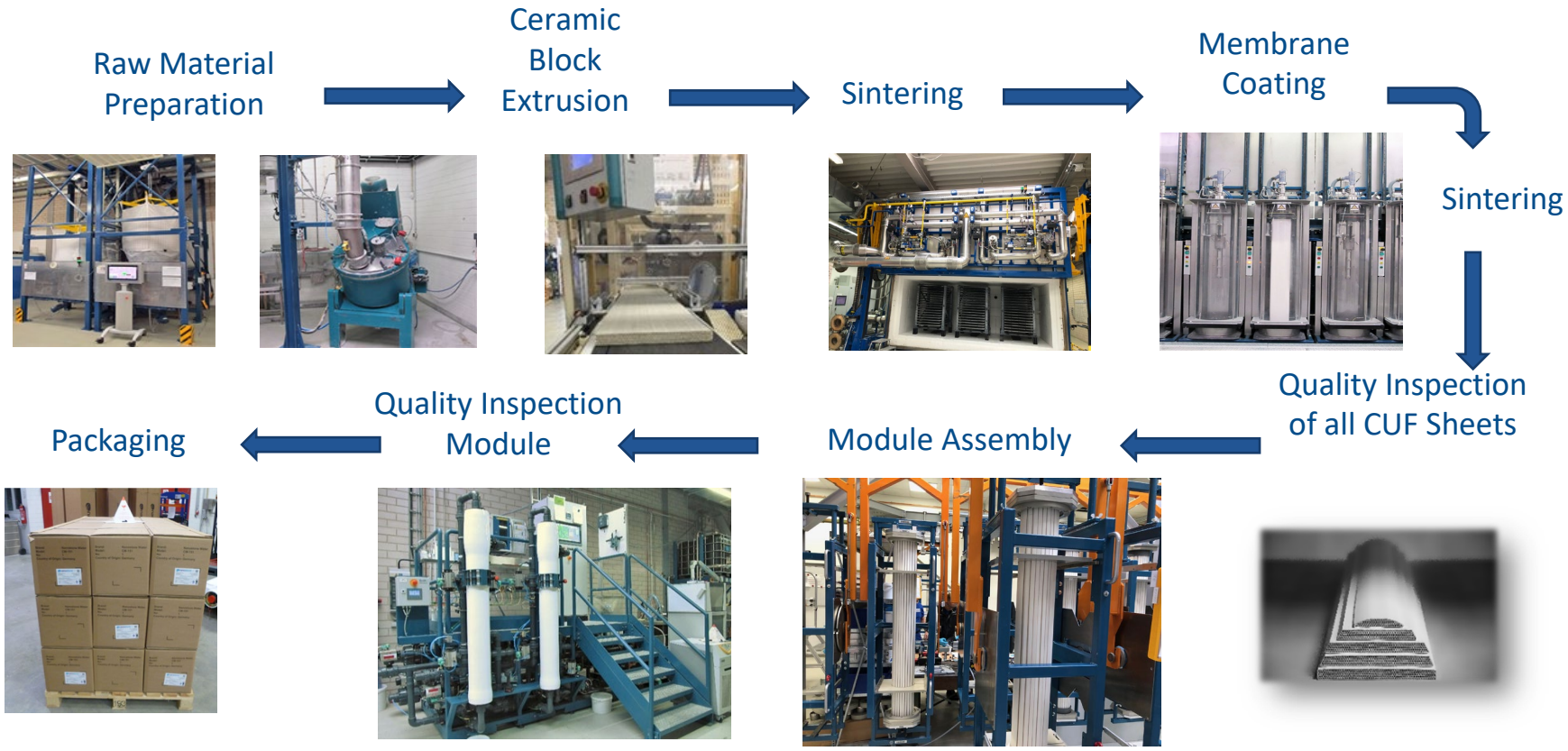
Membrane Characteristics

- 24.3 m^2 area (262 ft^2) α-Al_2O_3 Ceramic Membrane
- Membrane Coating of Nano Particles of α-Al_2O_3
- 2.4 mm Feed Channel Diameter

Specifications	Value
Module Length	75.5” / 192**cm**
Module Diameter	9.8” / 25**cm**
Module Dry Weight	176 **lbs** / 80**kg**

Operating Parameters	Value
Typical Flux Range	85-300 **gfd** / 150-500 **lmh**
Typical Flow Range	15-55 **gpm** / 3.5-12 **m^3/hr**
Operating Pressure Range	2.5 – 3.5 **bar** (Max 7 **bar**)

Innovative In-House Manufacturing Process



Patented design and vertically integrated quality certified production system

Certifications

NSF / ANSI 61 / 372 Certification

NSF / ANSI 419 Certification

Virus testing using MS2 Challenge – NSF

State Approvals in US

UK Regulation 31 Approved

China drinking water approval in process

CERTIFICATE OF COMPLIANCE

Certificate Number 20161202-MH61725
Report Reference MH61725-20161128
Issue Date 2016-DECEMBER-02

Issued to: Nanostone Water, Inc.
10250 Valley View Road, Suite 143
Eden Prairie MN 55344

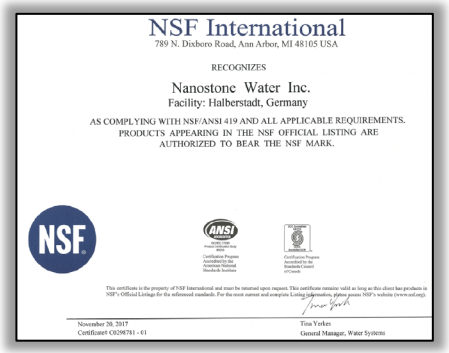
This is to certify that representative samples of DRINKING WATER SYSTEM COMPONENTS
Trade designation - CM-151.

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: NSF/ANSI 61–2014a
Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.



NSF International
789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Nanostone Water Inc.
Facility: Halberstadt, Germany

AS COMPLYING WITH NSF/ANSI 419 AND ALL APPLICABLE REQUIREMENTS.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE AUTHORIZED TO BEAR THE NSF MARK.

Virus Testing using MS2 Challenge – NSF – Consistent > 5.2 LRV using >2ppm coagulant
Cyst Testing using NSF 419 – Mean Result 5.66 LRV

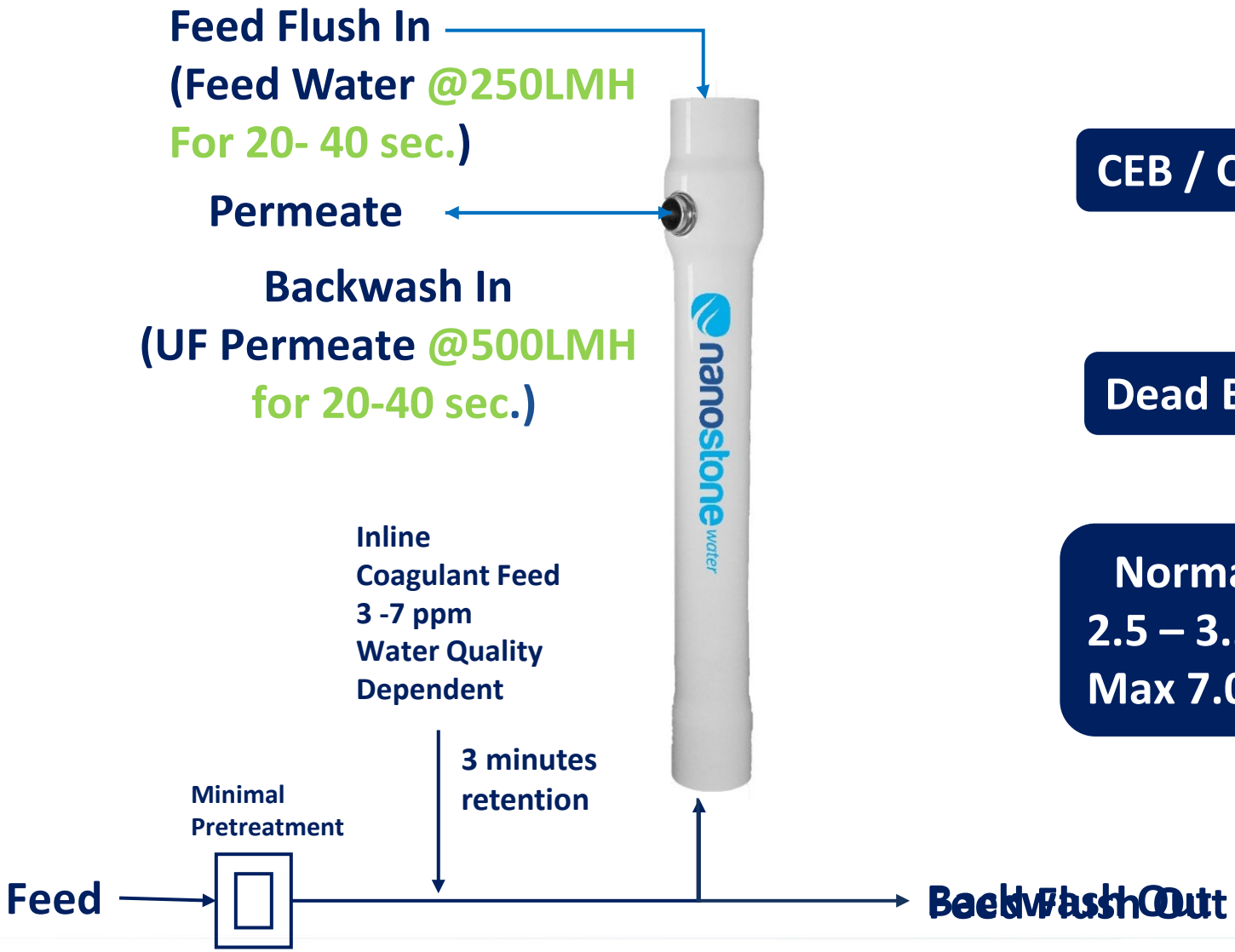
Pore Size & Distribution Independently Verified by:

- NSF International
- University of New Hampshire
- CT Associates, Inc.

Quantachrome Instruments Pore Size Results:

- Average pore size: 29 nm
- Standard deviation: 1 nm

Critical Parameters & Flow Directions



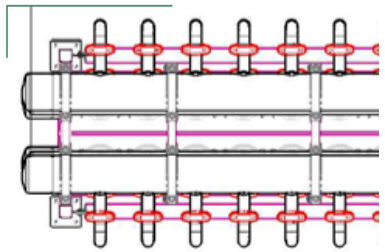
CEB / CIP /mCIP – No Caustic Soaking*

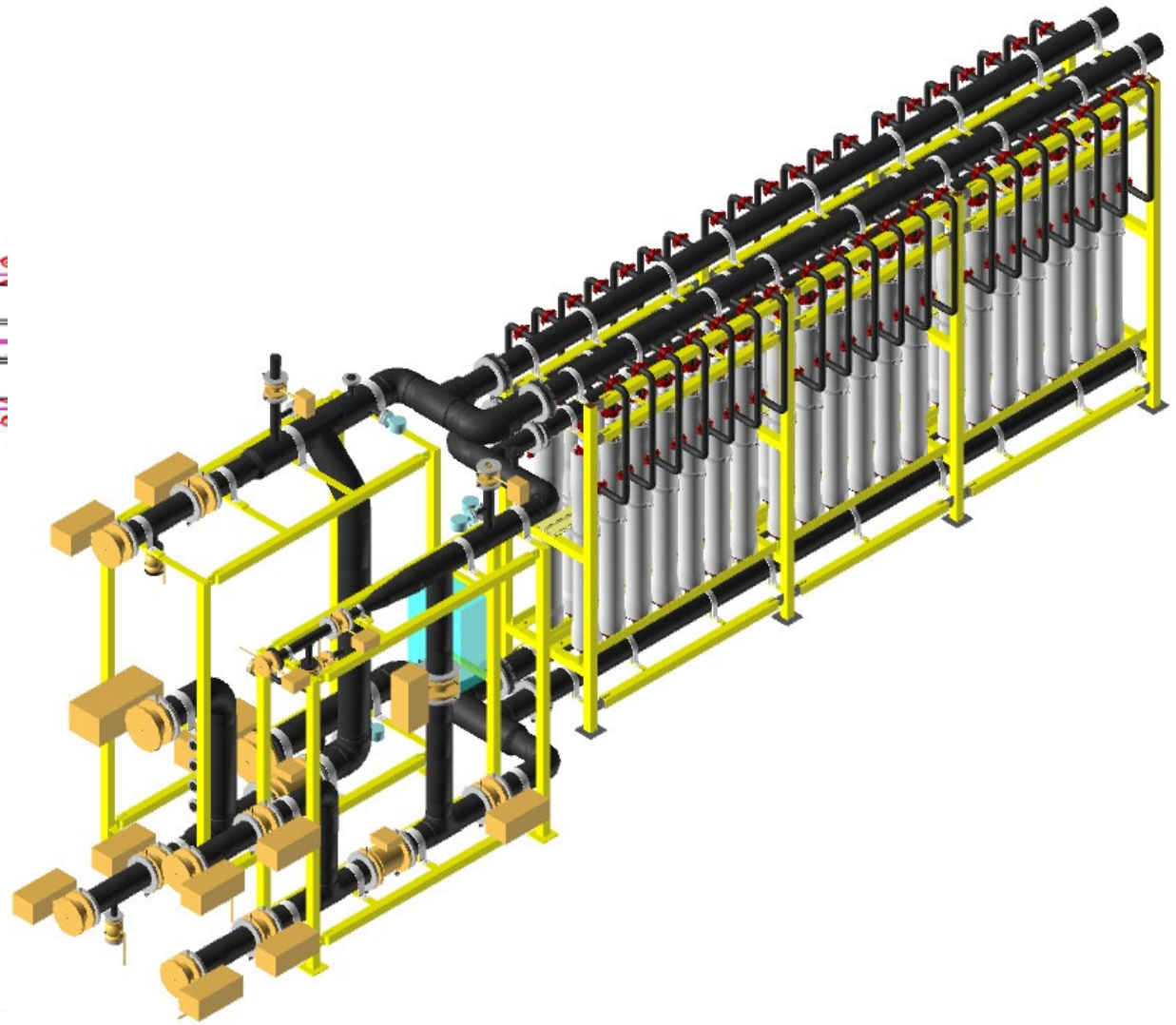
Dead End Operation Only

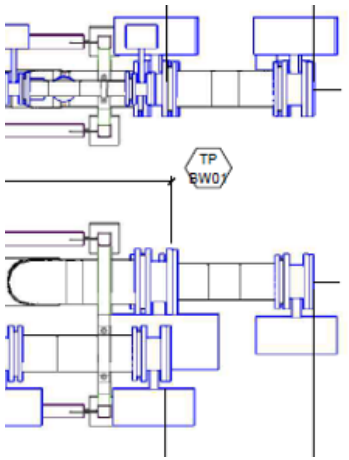
Normal Operating Pressure:
2.5 – 3.5 Bar
Max 7.0 Bar

*Only in case if feed water silica is high

Sample Rack Arrangement







References and Installed Systems since 2016

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CUF|Shield™ CUF|ShieldPlus™

>300 Systems With >60 References Sites

More than 90,000m³/day Treatment capacity

> 1,500 modules in ME industry.

	Client Name	Industr	Application	Install Da	Capa (m3	Ca (t
	Amkor Semiconductor Grinding WWR_Skid II ,III, IV,V	Microelectronics	Grinding Waste Water	2023	7200	1.90
1	Amkor Technology - Semiconductor	Microelectronics	Grinding Waste Water	2020	1,056	0.28
2	ASE Huanxu JS Semiconductor Grinding Waste Water Reuse	Microelectronics	Grinding Waste Water	2021	280	0.07
3	ASE Huanxu SX Semiconductor Grinding Waste Water Reuse	Microelectronics	Grinding Waste Water	2021	280	0.07
118	Changdian East Jiangyin Semiconductor WWR(23-01720)	Microelectronics	Grinding Waste Water	Jul 2024	2,160	0.57
117	Changdian East Jiangyin Semiconductor WWR(23-01720)	Microelectronics	Cutting Waste Water	Jun 2024	2,760	0.73
119	Corning Beijing GPW reuse project(SF No.23-01663)	Microelectronics	Glass Grinding WWR	Mar 2024	2,520	0.67
123	Corning Hefei GPW Retrofit project	Microelectronics	Grinding & Cutting WW Reuse		5,554	1.47
108	Corning-Chongqing Grinding Acid-Alkali WWR	Microelectronics	Grinding Waste Water	Jan 2024	2,160	0.57
114	Corning-Chongqing Grinding WWR Project (SF No.20230	Microelectronics	Glass Grinding WWR	Mar 2025	3,240	0.86
124	Ferrotec (Hangzhou)	Microelectronics	CMP Waste Water	Aug 2019	595	0.16
106	FST D Line, 4,200 CMD, back grinding WWR, phase 1 - 50%	Microelectronics	Grinding Waste Water		4200	1.11
125	Global Foundries	Microelectronics	HF Wastewater Reuse	Aug 2019	1,150	0.30
126	Hangzhou Shilan	Microelectronics	Grinding Waste Water	Jan 2020	1,008	0.27
112	Huatian Jiangsu Semiconductor WWR and stock	Microelectronics	Grinding & Cutting WW Reuse	Jan 2024	5,904	1.56
	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	Cutting Waste Water	Jul 2021	1200	0.32
	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	Synthetic System	Jul 2021	1200	0.32
138	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	Cutting Waste Water	Feb 2018	1,351	0.36
	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	Grinding Waste Water	Feb 2018	773	0.20
	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	Heavy Metal Waste Wat	Feb 2018	1,200	0.32
	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	Synthetic System	Feb 2018	1,200	0.32
	Huatian Technology (Kunshan) Electronics Co., Ltd	Microelectronics	High pressure System	Feb 2018	864	0.23
	Micron Batu Kawan Ph.2 WWR	Microelectronics	Grinding Waste Water	Feb 2021	600	0.16
150	Micron Muar WWR	Microelectronics	Grinding Waste Water	Oct 2020	360	0.10
155	Micron Bendemeer SG Grinding WWR	Microelectronics	Grinding Waste Water	Jan 2022	1,363	0.36
155	Nixi Semiconductor Technology	Microelectronics	Grinding Waste Water	Jul 2020	1,650	0.44
158	PSMC P3, CMP WWR	Microelectronics	CMP WWR	Jan 2022	150	0.04
159	Qingdao Huike Project	Microelectronics	Cutting Waste Water	Feb 2021	1,512	0.40
	Qingdao Huike Semiconductor Grinding Waste Water Reuse 22t/h	Microelectronics	Grinding Waste Water	Apr 2020	1,056	0.28
163	Qingdao Huike Semiconductor Grinding Waste Water Reuse 22t/h	Microelectronics	Grinding Waste Water	2020	1,200	0.32
168	Rirong Semiconductor CMP WWR Project	Microelectronics	CMP Waste Water	Jun 2023	420	0.11
169	Sandisk Mayiasia	Microelectronics	Grinding & Cutting WW Reuse	Dec 2017	480	0.126803
	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	Tap water Treatment	Apr 2022	1,920	0.51
	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	Dicing Waste Water	Jun 2020	720	0.19
	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	Cutting Waste Water	Mar 2020	600	0.16
	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	Cutting Waste Water	Jul - 2019	600	0.16
	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	UF Backwash Water Reuse	Sep 2018	600	0.16
178	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	Mixed Waste Water Reuse	Sep 2016	1,200	0.32
	Sandisk Technology (Shanghai) Electronics Co. Ltd. (Western Digital)	Microelectronics	Grinding Waste Water	Sep 2016	600	0.16
184	SEA Backgrinding and Dicing Saw WWR(ASE SG)	Microelectronics	Grinding Waste Water	Mar 2022	864	0.23
185	Semiconductor Manufacturing International Corporation (SMIC)	Microelectronics	HF Wastewater Reuse	Jun 2021	3,000	0.79
188	Shanghai Geke Semiconductor Wafer Waste Water Reuse_50t/h	Microelectronics	Grinding Waste Water	2021	280	0.07
189	Shanghai Jita Semiconductor Waste Water Reuse	Microelectronics	Grinding Waste Water		144	0.04
190	Shanghai Kaihong Project	Microelectronics	Grinding & Cutting WW Reuse	Mar 2021	1,378	0.36
195	Shaoyang Special Glass Grinding Wastewater Treatment Porject	Microelectronics	Grinding & Cutting WW Reuse	Jan 2023	1,080	0.29
116	Tongwei Solar-Meishan-PV WWR project (23-01738)	Microelectronics	Glass Grinding WWR	Jun 2024	1,920	0.51
196	Universal Scientific Industrial(Shanghai)Co., Ltd.(ASE HUANXU)	Microelectronics	Grinding & Cutting WW Reuse	Feb 2018	288	0.08
200	Wistron Corporation (Kunshan)	Microelectronics	Grinding & Cutting WW Reuse	Aug 2018	5,040	1.33
	Wistron Corporation (Kunshan)	Microelectronics	UF Backwash Water Reuse	Aug 2018	214	0.06
201	Wuhan Huawei As waste water project	Microelectronics	Heavy Metal Waste Water	Mar 2019	240	0.06
111	Xianyang Caihong Semiconductor Glass Grinding WWR Pr	Microelectronics	Glass Grinding WWR	Apr 2024	2,160	0.57
208	Xinsheng Semiconductor WWR	Microelectronics	Grinding Waste Water	Nov 2022	1,440	0.38
	Xinsheng Semiconductor WWR	Microelectronics	CMP Waste Water	Nov 2022	1,920	0.51
214	Yongxi (FHEC) Electronic Wastewater Reuse	Microelectronics	Grinding Waste Water	May 2023	2,160	0.57
	Yongxi (FHEC) Electronic Wastewater Reuse	Microelectronics	Cutting Waste Water	May 2023	3,480	0.92
216	ZGD TFT-LCD Grinding and Cutting WWR	Microelectronics	Grinding & Cutting WW Reuse	Mar 2021	1,848	0.49
	ZGD TFT-LCD Grinding and Cutting WWR Phase II	Microelectronics	Grinding & Cutting WW Reuse	Apr 2022	800	0.21

> 40 Systems in BG, Dice, Saw

> 5 Systems In CMP WW

> 3 Systems In HF WW

> 10 Systems Mixed Waste

Part of the references, full list please refer to the general reference list

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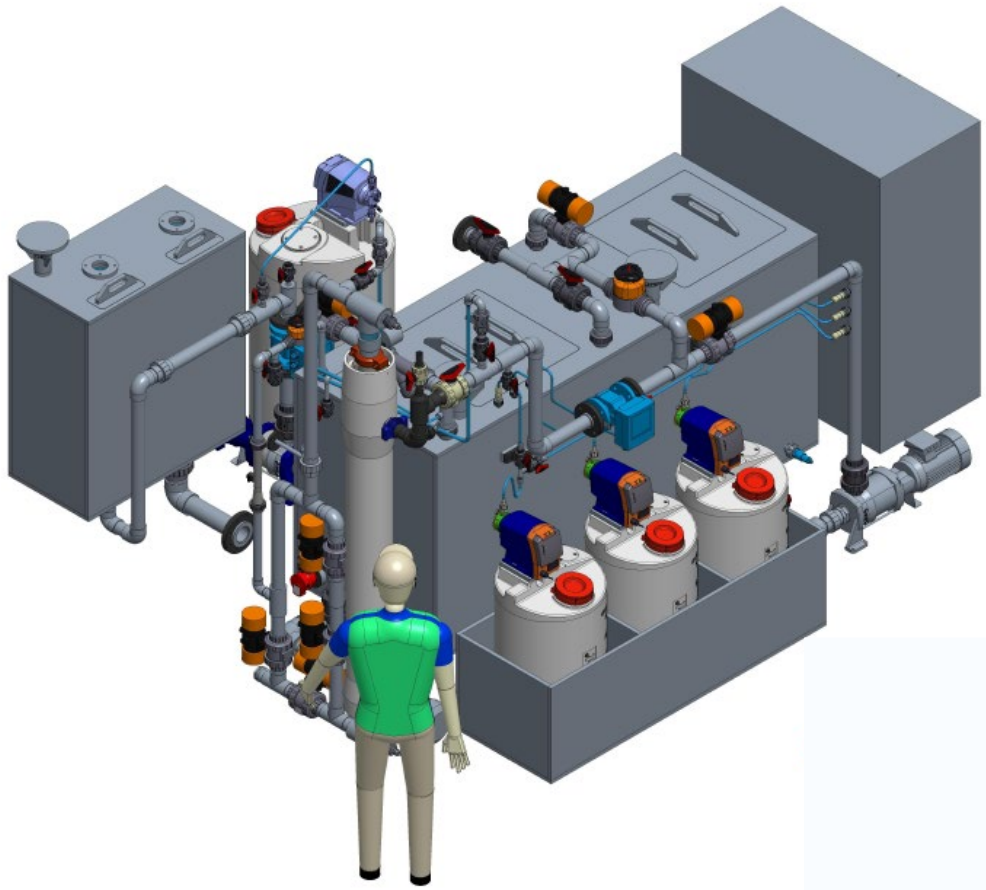
Mobile Pilot Units



Our industrial pilot systems, housed in a 20ft or 40ft containers, are available for rent to validate ceramic UF performance in industrial wastewater reclaim, water treatment and SWRO—delivering rapid, repeatable results that are scalable with minimal site disruption.

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Case Study: A Semiconductor Manufacturing Plant

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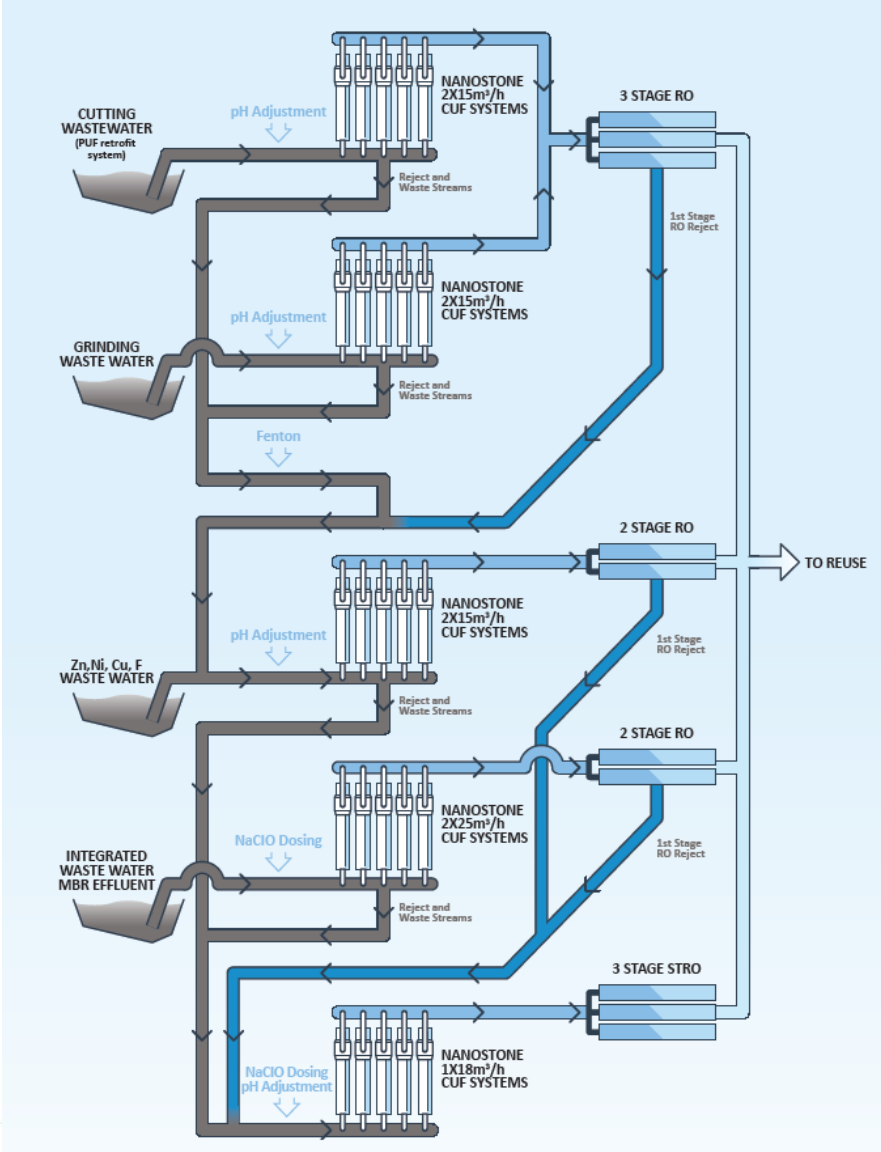
Application: Wastewater Treatment – Expansion & Upgrade

Improve the treatment process by replacing the existing system with CUF|Shield™ technology and installing additional CUF|Shield™ membrane systems to treat other waste streams.

The Result:

- ✓ The treatment and discharge of 158m³/h of wastewater has been reduced thru reuse with a system **water recovery rate greater than 95%.**
- ✓ **Maintenance and labor has been reduced,** and CIP frequency has been extended to more than three months between cleanings.
- ✓ The downstream **RO system has been protected**, ensuring consistent, reliable production.
- ✓ Treatment capacity has been maintained significantly longer.



Case Study: A Thermal Power Plant

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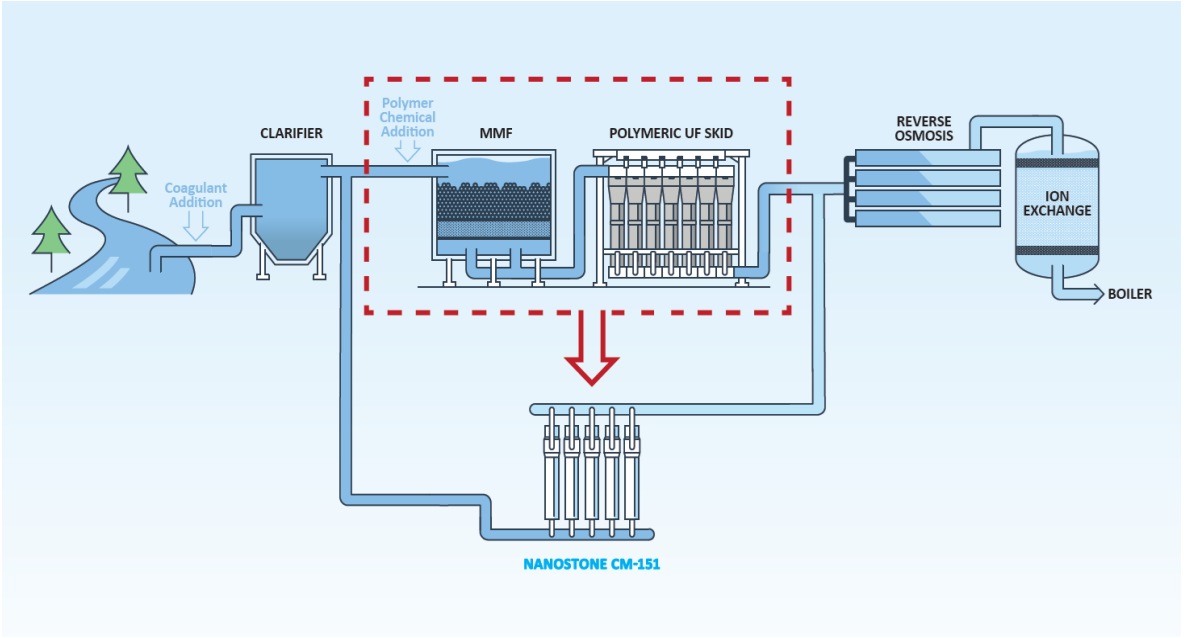
Application: Surface Water Treatment for Boiler Feed Water

Implementation of a Nanostone CUF|Shield™ Ceramic Ultrafiltration Membrane System quickly allowed the plant to:

- ✓ Run consistently at 90m³/h, **doubling the capacity** within the same footprint.
- ✓ **Simplified treatment scheme**.
- ✓ Achieve **reliable permeate quality** with SDI values < 2.
- ✓ Increase overall **water recovery rate to > 95 %**, achieved by reducing CIP cleanings to once every six months.
- ✓ Significantly **reduces the requirement of coagulant** and **avoids dosage of polymer**.



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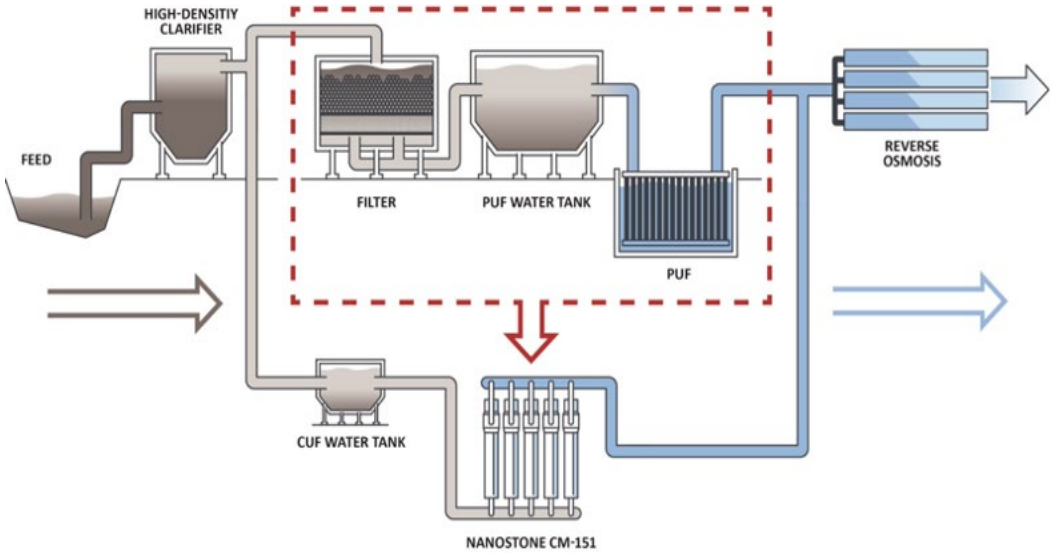
Case Study: A Coal Mining Plant

Application: Wastewater Recycling

Challenge Overview:
A Coal Mine faced issues with its existing filtration system, including **frequent fouling and high maintenance**, which compromised treatment capacity.

Nanostone Solution:
Implementing the CUF|Shield™ ceramic ultrafiltration membrane system provided a robust, reliable solution that stabilized the downstream RO system and **increased treatment capacity by 44%**.



Benefits Achieved:

- ✓ **Reduced maintenance** needs due to fewer chemical cleanings.
- ✓ **Improved system reliability** and **compliance with environmental regulations.**
- ✓ **Increased operational efficiency** and extended membrane life.

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Thank you

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Life's Essentials. **Performance Solutions.**

www.acuriant.com