Better Plants®
U.S. DEPARTMENT OF ENERGY

NAWI
National Alliance for Water Innovation

Industrial Water Reuse Monthly Webinar & Clinic

September 2026:
Mapping Your Path Toward Water Reuse

Better Buildings & Better Plants Initiative

Better Buildings™
Better Plants
U.S. DEPARTMENT OF ENERGY

The Better Buildings & Better Plants Initiative is a voluntary market engagement program for industry to partner with DOE to invest in innovative energy technologies and implement practices that save money and improve the productivity of our nation's commercial buildings, industrial plants, and homes.

650+ partners with portfolio-wide goals

3.9 Qbtu
energy saved

$24+ B
cost savings

3,400+
partner solutions published

$41B
funding extended by private sector Financial Allies

Better Plants CHALLENGE
U.S. DEPARTMENT OF ENERGY

Through the **Better Plants Challenge**, manufacturing organizations commit to improve energy performance throughout their U.S. portfolio of plants by at least **25% over 10 years** and share their strategies and results.

Additional Better Buildings & Better Plants partnership opportunities

- 50001 Ready Program
- Residential Network
- Commercial Building HVAC Accelerator
- Design and Construction Allies
- Financial Allies
- Industrial Technology Validation
- Industrial Energy Management Workforce
- Onsite Energy Program
- National Laboratory Technology Research Teams and Campaigns
- Waste Reduction Network
- Water Savings Network

Water Savings Network

- **80+ partners across sectors**
- **18+ Goal Achievers**
- **22+ billion gallons in cumulative water savings**
- **160+ proven water savings solutions**

What is it?

- Partners can work with DOE to track a water savings goal across all or a portion of their portfolios (e.g., in water stressed regions).
- A network of Better Buildings & Better Plants partners that participate in peer exchange activities and gain recognition for their proven solutions.

Why join?

- Receive technical guidance from DOE and supporting organizations.
- Be a part of a network of peers.
- Set a water goal for all or a portion of portfolios (e.g. in water-stressed regions).
- Get recognition for proven solutions.

What do organizations commit to?

- Participating in water-based Better Buildings & Better Plants activities like tracking and reporting water data, publishing a water-related solution on the Solution Center, or sharing best practices and lessons learned with peers.

Meet the Team

U.S. Department of Energy

John O'Neill
Technology Manager

Andrew Whitlock, CEM

NAWI

Dr. Peter Fiske

Lawrence Berkeley National Laboratory

Susana Garcia, PhD

Prakash Rao, PhD

Meena Venkatraman
Webinar Support & Analysis

Submit questions at www.slido.com

using your mobile device, or by opening a new window

Enter Event Code

#WaterReuse

Dr. Peter Fiske

Founding Executive Director

National Alliance for Water Innovation (NAWI)

U.S. DEPARTMENT of ENERGY

National Alliance for Water Innovation

DOE's Energy-Water Innovation Hub

- Headquartered at Lawrence Berkeley National Laboratory
- Supports applied research in advanced water treatment across the U.S.

Technical Highlights

- 70+ projects since 2020 focused on desalination, advanced water treatment and reuse

Partnerships with Industry

- 53 industry partners including EPRI, Exxon, NGL, Eastman Chemical, Freeport MacMoRan, Tetra Tech, TSMC

Learn more at www.nawihub.org

WateReuse Association

- Only trade association solely dedicated to advancing laws, policy, funding, and public acceptance of recycled water
- State-level chapters + annual meeting (~March)
- Industrial Water Reuse Conference

WEF | WATEREUSE
INDUSTRIAL WATER SOLUTIONS

POWERING THE CIRCULAR WATER ECONOMY
Water Environment Federation
WATEREUSE

RECYCLED WATER USER NETWORK™

EPA’s National Water Reuse Action Plan (WRAP)

- Nationwide framework for advancing water reuse
- WRAP 2.0 emphasizes reuse for industry, the technology sector, and energy dominance

Next Month's Webinar: Wednesday October 21 – 1 PM ET/10 AM PT

Speaker: Dr. Naushita Sharma (Oak Ridge National Laboratory)

Title: Where am I in Water Use? Leveraging DOE Tools to Quantify Plant Water Use

Plant Water Profiler: A Tool for Understanding Water Use, Cost and Savings Potential for Manufacturing Plants

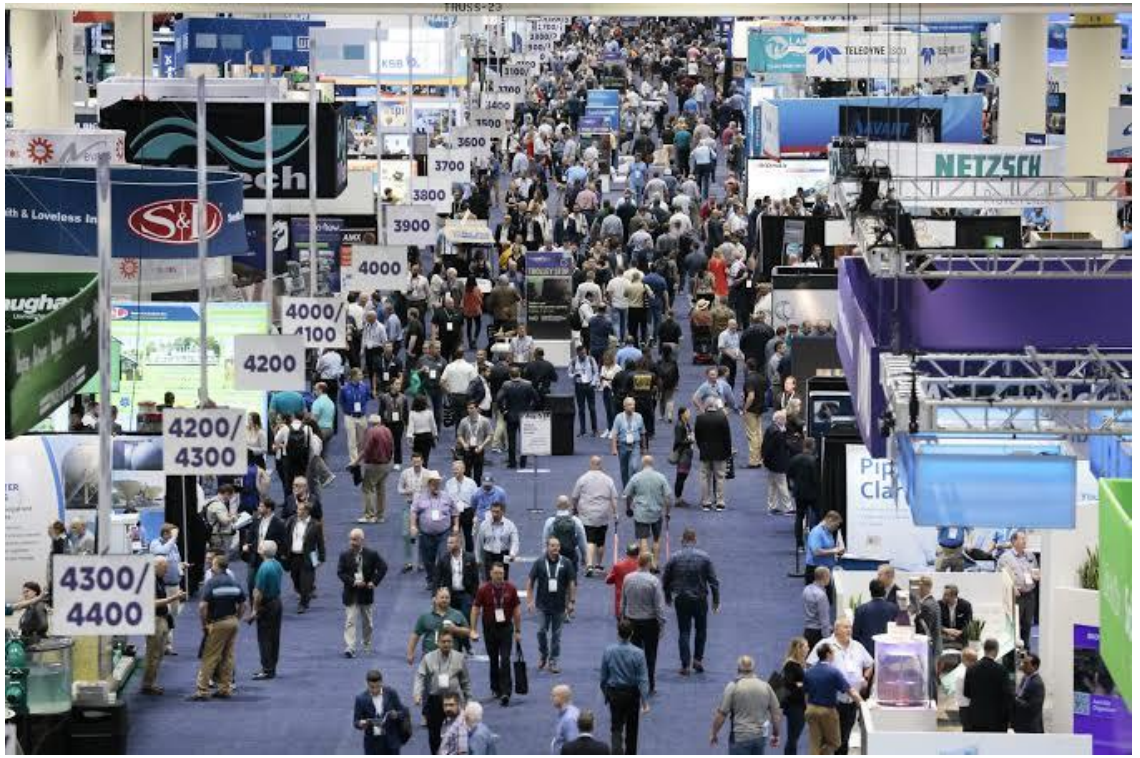
And if you're going to WEFTEC next week in New Orleans…

Better Plants has a booth (8128)

Naushita Sharma has a talk:

Tuesday September 29 3:30-4:00 PM

Beyond the Water Bill: A Framework to Quantify the True Cost of Water in Industrial Facilities



Join us after Naushita's talk at 4:30 PM at the Better Plants Booth (8128) for an informal gathering – meet the experts!

Today's Presenters

Michelle Maddaus, PE
Maddaus Water Management

Darren Dimma
General Motors

INDUSTRIAL WATER REUSE

Practical strategies, proven case studies and keys to success

Maddaus Water Management

September 2026

Why industrial reuse belongs in the operating plan

Water projects create value beyond the purchased-water line item

Reuse turns a discharge stream into a reliable utility source.

Water savings also save energy

Water must be moved, heated, cooled and treated.

- **SUPPLY RESILIENCE** — Reduce exposure to drought curtailments and constrained freshwater supplies.
- **CAPACITY** — Free water and wastewater capacity for production growth or new facilities.
- **TOTAL COST** — Avoid treatment, pumping, heating, chemical, sewer and discharge costs.
- **PERFORMANCE** — Supply water tailored to the process instead of accepting variable source quality.

Sources: U.S. EPA; U.S. DOE Better Plants

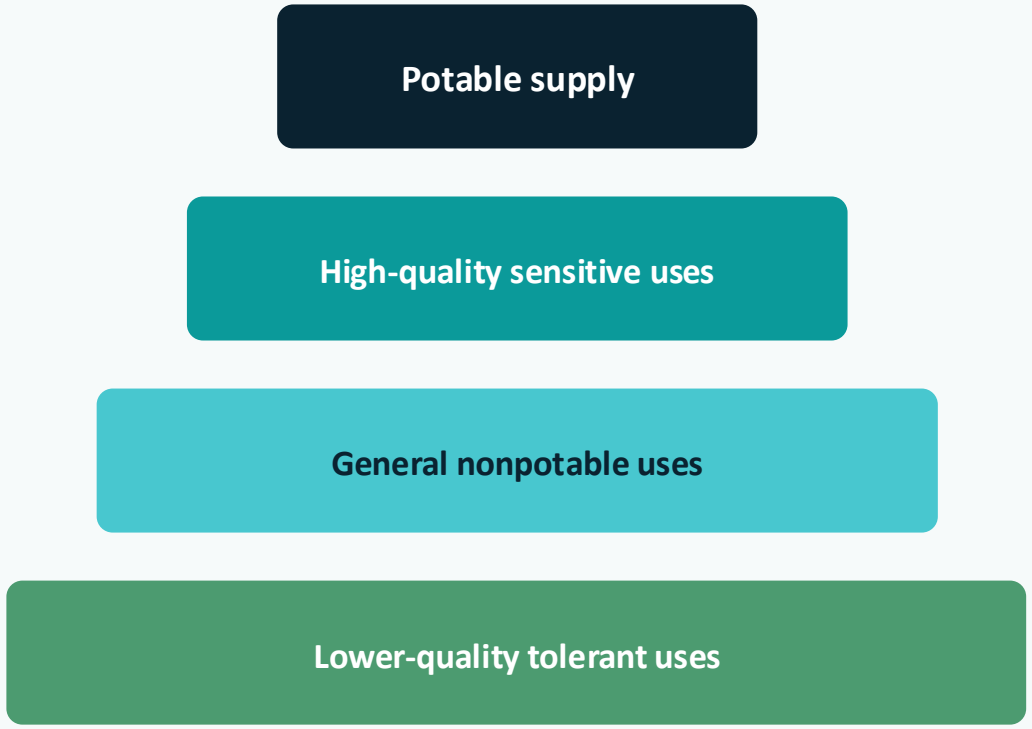
Water management hierarchy

Reuse works best after preventable demand has been removed

1. **AVOID** — Remove water uses that do not support production or safety
2. **REDUCE** — Improve controls, maintenance and operating practices
3. **RECIRCULATE** — Keep water in the same process for additional cycles
4. **RECLAIM ONSITE** — Treat one stream for a different use inside the facility
5. **USE ALTERNATIVE SUPPLY** — Purchase municipal recycled water or another approved source

The fit-for-purpose approach

The end use determines the water quality target and treatment cost



Right quality. Right cost. Right benefit.

1

Define the end use

Start with the receiving process and its operating limits.

2

Set the water quality target

Translate product and equipment needs into measurable limits.

3

Select only the treatment needed

Avoid paying for potable quality when the end use is tolerant.

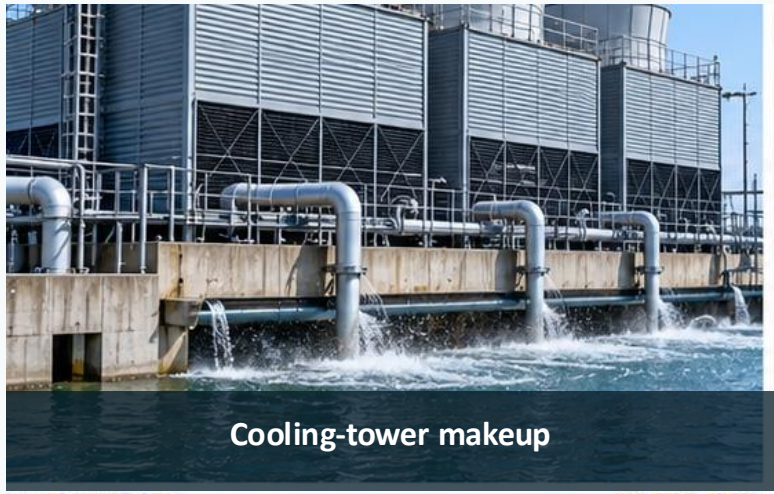
4

Protect the process and the environment

Define monitoring, response limits, bypass and residuals.

Where reclaimed water can be used

Common applications range from utility systems to wash processes and site uses



Cooling-tower makeup

Boiler and high-quality utility feed

Process wash and rinse

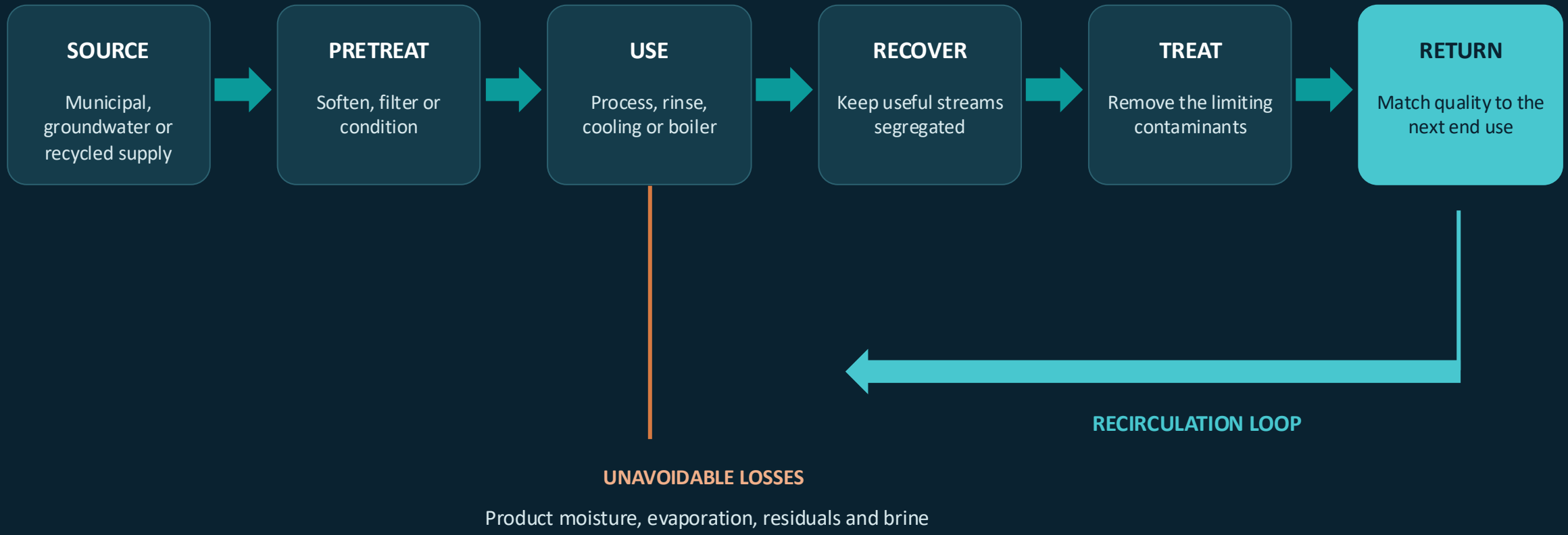
Landscape irrigation

Dust control

Storage and distribution

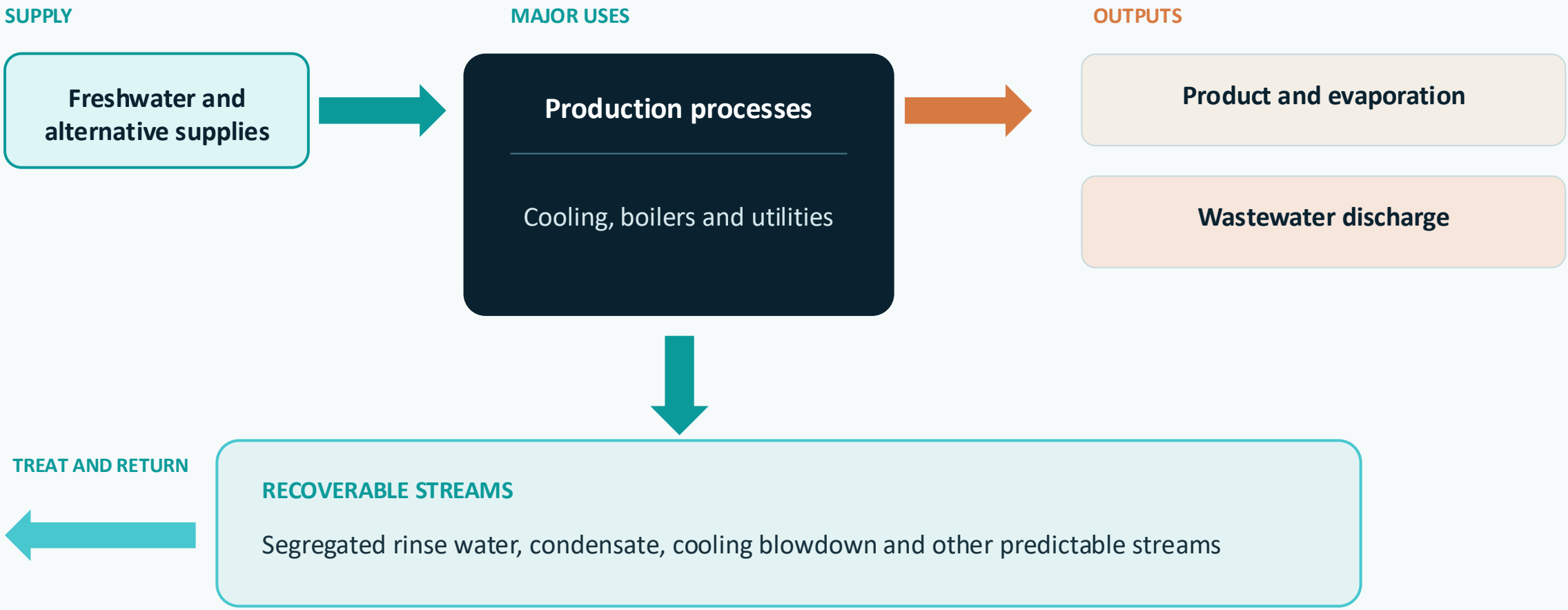
The industrial water loop

A reliable water balance shows where reuse can close the loop



The facility water balance

Meter each major source, use, loss and discharge before sizing a reuse system



Best reuse candidates are steady, segregated and nearby

Start with streams whose quality and flow are easy to control

Condensate
Low dissolved solids; often warm and predictable

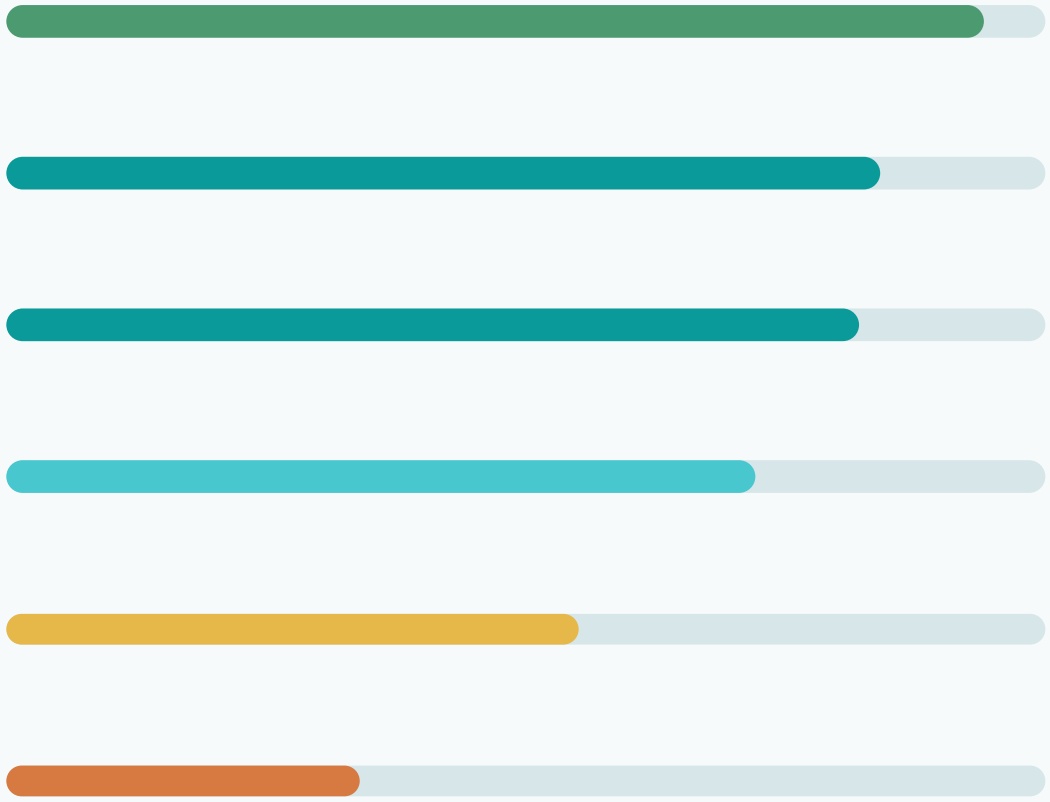
Final rinse water
Relatively clean when kept separate from first rinse

Noncontact cooling
High volume and low contamination risk

Cooling-tower blowdown
Steady flow; hardness, silica and TDS drive treatment

RO reject
Continuous but concentrated in salts

Mixed wastewater
Large volume but variable and treatment intensive



FIRST SCREEN

Volume

Variability

End-use tolerance

Distance

Residuals

Sources: EPA WaterSense; DOE Better Plants

Source-to-end-use matching

Strong projects connect a predictable stream to a nearby use that can accept its quality

RECOVERABLE SOURCE	TREATMENT DIRECTION	POTENTIAL END USE
Clean condensate	Heat recovery and polishing as needed	**Boiler or wash-water supply**
Final rinse water	Filtration and microbial control	**Earlier rinse stage**
Noncontact cooling water	Temperature control and monitoring	**Cooling-system makeup**
Cooling-tower blowdown	Softening, filtration or RO	**Cooling, washdown or approved site use**

These are screening examples, not design criteria.

Fit-for-purpose water quality

Treat the recovered stream only to the quality the end use requires

END USE	PRIMARY WATER-QUALITY CONCERN	TYPICAL TREATMENT DIRECTION
Cooling-tower makeup	Hardness, silica, conductivity, microbes	Filtration, softening or RO as needed; biocide and monitoring
Boiler feed	Hardness, dissolved solids, silica, oxygen	Softening, RO or demineralization; deaeration and chemistry control
Wash and rinse	Product contact, spotting, corrosion, finish quality	Source separation plus filtration; advanced treatment where quality demands it
Irrigation or dust control	Pathogens, salinity, metals and local limits	Treatment and disinfection matched to approved non-potable use

Confirm applicable health, product-contact, discharge and reuse requirements before final design.

Sources: U.S. EPA water reuse resources

Eight factors shape a viable reuse project

Technical design, economics and operating ownership must work together

01 **Water quality and supply**

Reliability, contaminants and seasonal variation

02 **End-use requirements**

Required quality, volume and continuity

03 **Regulatory pathway**

Applicable permits and public acceptance

04 **Treatment technology**

Proven performance under site conditions

05 **Infrastructure**

Piping, storage and backflow protection

06 **Financial viability**

Capital, operating cost and avoided cost

07 **Operations and maintenance**

Staffing, monitoring, chemicals and reliability

08 **Risk management**

Health, safety, environment and continuity

Concept adapted from the supplied reference slide

Treatment train options

The source quality and end use determine which steps belong in the final train

Not every project needs every step.

Treatment trains follow the contaminants

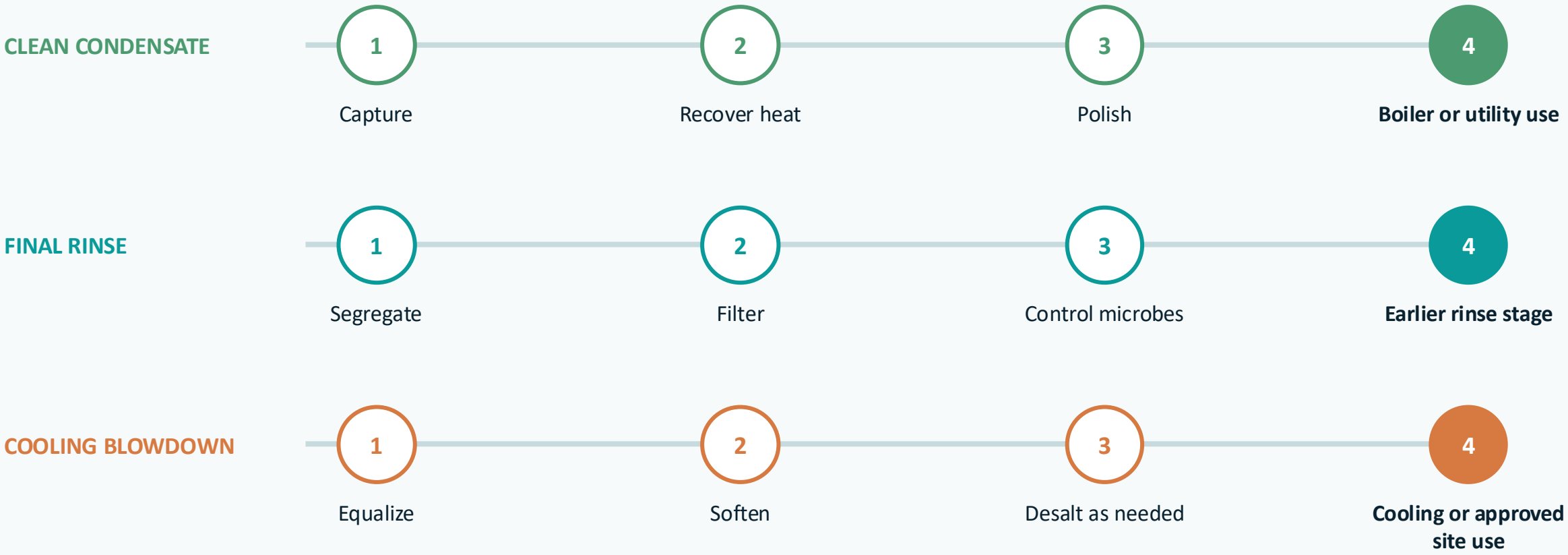
Each step removes a defined constraint on the next use

Residuals are part of the treatment train

Plan brine, sludge, spent media, off-spec water and bypass conditions at the same time as product water.

Three example treatment paths

Each path removes only the constraints that matter to the selected end use



Confirm treatment through sampling, piloting and end-use acceptance testing.

The business case is larger than the water bill

Calculate the true cost at the point of use and discharge

PURCHASE	Freshwater supply and demand charges
CONDITION	Pretreatment, softening and membrane losses
MOVE + HEAT	Pumping, cooling, heating and steam energy
OPERATE	Chemicals, labor, sampling and maintenance
DISCHARGE	Sewer, surcharges, hauling and residuals
RISK	Production constraints, curtailment and expansion delay

TRUE COST OF WATER

All six layers

Screen economics twice

1 Direct payback
2 Capacity and resilience value

Source: U.S. DOE Better Plants

Reuse economics worksheet

Use site data and show each assumption so the business case can be updated

1	**ANNUAL RECOVERED VOLUME**	Average recovered flow × operating days
2	**AVOIDED ANNUAL COST**	Recovered volume × true cost of purchased and discharged water
3	**NET ANNUAL BENEFIT**	Avoided cost − reuse operating cost − residuals handling
4	**SIMPLE PAYBACK**	Installed project cost ÷ net annual benefit
	Sensitivity checks	Current and future rates, production growth, uptime, residuals cost and water-supply constraints

Project screening scorecard

Advance candidates that pass all five gates

01	**MATERIAL VOLUME**	Enough recoverable flow and operating hours to matter
02	**PREDICTABLE QUALITY**	Variation can be buffered, monitored and treated
03	**COMPATIBLE DEMAND**	A nearby end use accepts the treated water year-round
04	**COMPLETE ECONOMICS**	Avoided costs and capacity value exceed lifecycle cost
05	**CLEAR PATHWAY**	Permits, residuals, ownership and bypass are defined

No gate should rely on assumed data

Implementation roadmap

Each stage produces a decision-ready deliverable

WATER BALANCE

Metered flow map and true cost

CHARACTERIZE

Seasonal quality and load envelope

MATCH

Source-to-end-use shortlist

PILOT

Performance, fouling and residuals data

DESIGN

Basis, permits, cost and controls

COMMISSION

Acceptance tests and operator ownership

Decision gates

Baseline confirmed, reuse match accepted, pilot criteria met, lifecycle case approved, operators ready

PILOT STUDY DESIGN

A pilot should answer operating questions

Test through real production variability before full-scale design.

1. Recovery across the full production cycle
2. Water quality at the receiving process
3. Cleaning frequency and chemical demand
4. Residuals quantity and disposal route
5. Automatic response to off-spec water

The pilot plan should define success criteria before testing begins.

Conceptual pilot facility image

KPIs that prove reuse value

Track water quantity, quality, reliability and cost together

01 — **RECOVERY RATE**

Recovered flow ÷ source flow

02 — **POTABLE OFFSET**

Freshwater avoided by verified meter

03 — **REUSE UTILIZATION**

Reused flow ÷ available treated flow

04 — **QUALITY COMPLIANCE**

Time within end-use specifications

05 — **SYSTEM AVAILABILITY**

Hours available ÷ scheduled hours

06 — **TOTAL UNIT COST**

Lifecycle cost per 1,000 gallons delivered

A reuse system succeeds only when it delivers on-spec water when production needs it.

Most failures start outside the membrane system

Recurring design, operating and commercial gaps

01	**Mixed streams too early**	Combining clean and dirty flows creates a larger, more expensive treatment problem.
02	**Average water quality**	Designing to the average misses peaks in salts, organics, temperature and production chemistry.
03	**Residuals left for later**	Brine, sludge and off-spec water can control cost, permits and system availability.
04	**No operating owner**	Unmaintained instruments and unclear response limits quickly undermine trust in reuse water.
05	**Water-bill-only economics**	Projects stall when capacity, energy, discharge and production-risk value remain invisible.

Keys to success

Seven practices that consistently improve project performance

1. **Build a metered water balance**
   Use real flow and operating-hour data.

2. **Separate streams at the source**
   Protect clean water before it becomes wastewater.

3. **Match quality to the end use**
   Set limits from equipment and product needs.

4. **Value the complete business case**
   Include energy, discharge, capacity and risk.

5. **Pilot across real variability**
   Test shifts, seasons and production changes.

6. **Design residuals and redundancy early**
   Plan brine, bypass, storage and critical spares.

7. **Give operators ownership**
   Define alarms, response limits and KPI review.

Facility opportunity discussion

Use the questions below to identify one strong candidate for further study

DISCUSSION QUESTION	FACILITY NOTES
Which stream leaves a process relatively clean and separate?	*Add notes here*
How much flow is available, and when is it available?	*Add notes here*
Which nearby use can accept that volume and quality?	*Add notes here*
What limits, permits, monitoring and residuals must be addressed?	*Add notes here*
Who will own the pilot, operating response and performance review?	*Add notes here*

A practical 90-day start

Move from broad interest to one decision-ready pilot

DAYS 0–30

BASELINE

Confirm meter data, production schedule, utility costs and the cross-functional owner.

DAYS 31–60

CHARACTERIZE

Sample the top three streams, identify compatible end uses and define treatment limits.

DAYS 61–90

SELECT

Choose one or two pilot candidates, set success criteria, assign budget and map permits.

Best first project

A clean, consistent stream that can replace a nearby, tolerant demand.

CLOSING TAKEAWAYS

Industrial reuse succeeds when the project fits the facility

1. Measure actual flow and variability before sizing the system.
2. Pair the source and end use before selecting treatment.
3. Build the business case on total cost and capacity value.
4. Pilot long enough to capture real production changes.
5. Give operators ownership from design through commissioning.

QUESTIONS AND DISCUSSION

CASE STUDY 1 OF 3

Frito-Lay Casa Grande

Casa Grande, Arizona | Food manufacturing

PROCESS WATER RECOVERY

650,000
gpd recovery-system design capacity

Up to 75%
of process water recycled

~100M gal/yr
reported annual water savings

Treatment train

MBR + reverse osmosis + carbon + UV

Why it worked

The plant paired a large, consistent process stream with advanced treatment and a defined reuse destination inside production.

Source and photo: CDM Smith

CASE STUDY 2 OF 3

Intel Ocotillo and the City of Chandler

Chandler, Arizona | Semiconductor manufacturing

ONSITE RECLAMATION + MUNICIPAL PARTNERSHIP

12 acres
on-site reclamation facility

9.1 MGD
maximum on-site treatment capacity

2.8 MGD
brine-reduction facility capacity

Water strategy

Recover water inside the campus, then use the joint brine-reduction facility to address hardness, silica and dissolved solids.

Why it worked

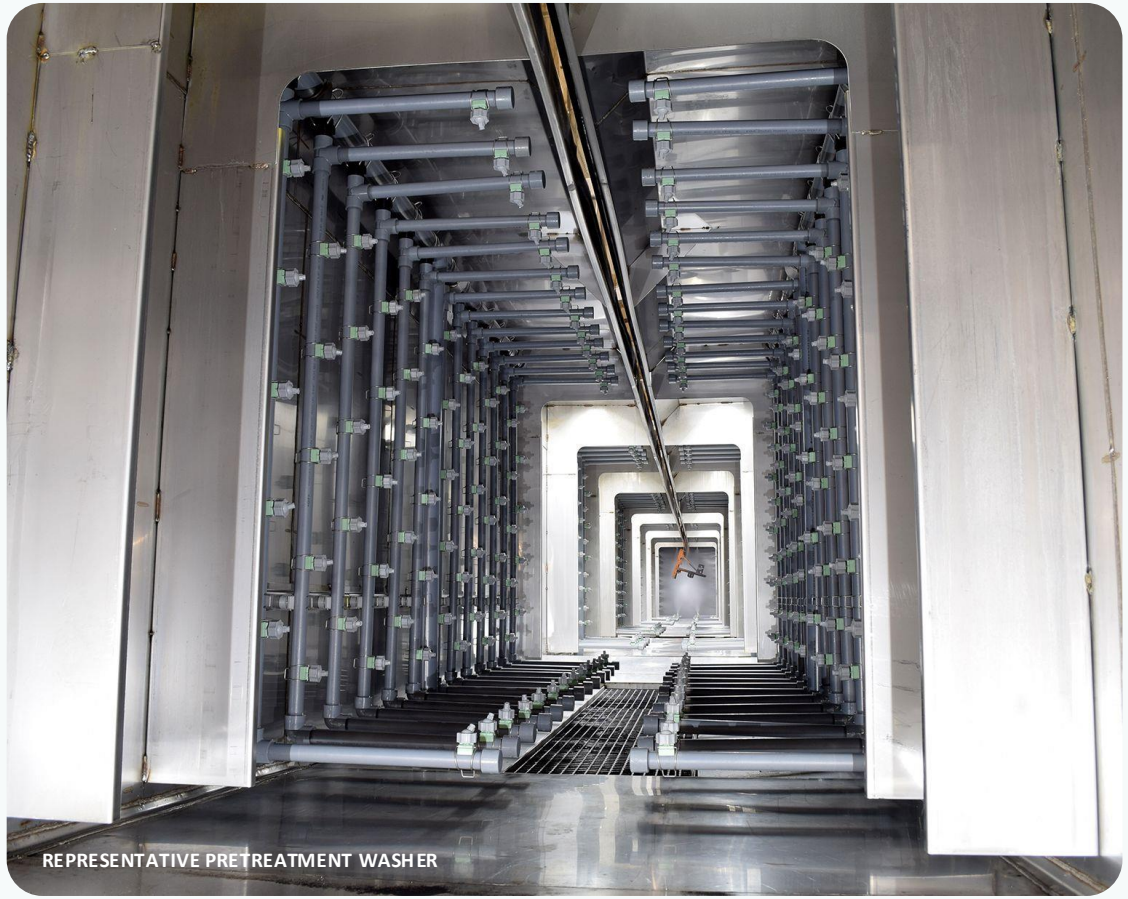
Site treatment and city infrastructure solve different constraints while protecting a scarce desert supply.

Photo credit: Intel / Arizona Digital Free Press

CASE STUDY 3 OF 3

Steelcase and DuBois

United States | Metal finishing pretreatment



REPRESENTATIVE PRETREATMENT WASHER

COUNTERFLOW RINSE + PROCESS CHEMISTRY

80%
less water required in the improved process

85–95%
less wastewater discharge

>45M gal/yr
global water reduction after rollout

$1.05M/yr
reported total operating savings

Operating change

Counterflow rinsing, low-temperature nonphosphate chemistry, RO water and fewer process inputs and outputs.

Why it worked

A supplier-led trial optimized total operating cost rather than chemical price alone.

Sources: FMA; EPA Green Suppliers Network

Food and beverage reuse opportunities

Clean stream separation can lower treatment cost while protecting product requirements

CONCEPTUAL CLEAN-IN-PLACE REUSE SYSTEM

01 — **Final-rinse capture**

Use a validated final rinse as an earlier rinse or cleaning step.

02 — **Condensate recovery**

Segregate clean condensate before it reaches the wastewater system.

03 — **Cooling and utilities**

Match reclaimed water to noncontact systems with defined quality limits.

04 — **Resource recovery**

Evaluate heat, solids and concentrated by-products with the water balance.

General Motors: The Water Challenge & Our Approach

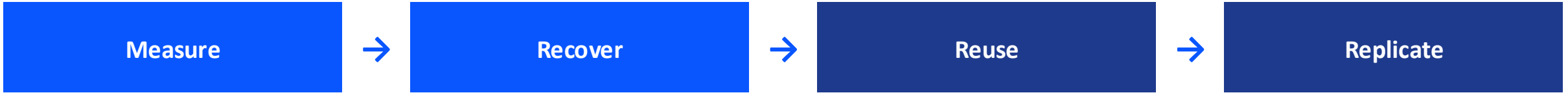
- Water is a low-cost commodity, which makes ROI challenging — yet reducing withdrawals is critical to GM's goal of reducing water intensity 35% by 2035 versus a 2010 baseline (5.71 → 3.71 m^3/unit)
- Barriers: minimal digitalization / metering (“can't fix what you don't measure”), space constraints, investment and variable potable water quality

A connected, three-part strategy turns lost water into reused water

1 Measure Water intelligence systems to find water-using areas and anomalies

2 Recover RO Reject Recovery systems to reclaim water otherwise sent to drain

3 Reuse & Replicate Water Treasure Hunts to surface reuse opportunities and scale wins, including water-stressed operations



Step 1 — Seeing Where Water Goes

- Internal or external resources available – START SMALL!
- Real-time visibility, enterprise benchmarking, and expert-driven insights
- Clamp-on flow meters create portable / relocatable options
- Assembly Facility pilot: ~20 meters; weekly reviews with 3rd party company to identify anomalies and continuous-improvement opportunities
    - Initial meter purchase cost + monthly/annual subscription fee based on # of meters. ~$35k initial setup + ~$35K annual subscription
- Identify water-using areas and abnormal flows — e.g., RO rinse header / nozzle repositioning delivered ~20 gpm reduction

Proven Results at one of our Vehicle Assembly Facilities

12.1M

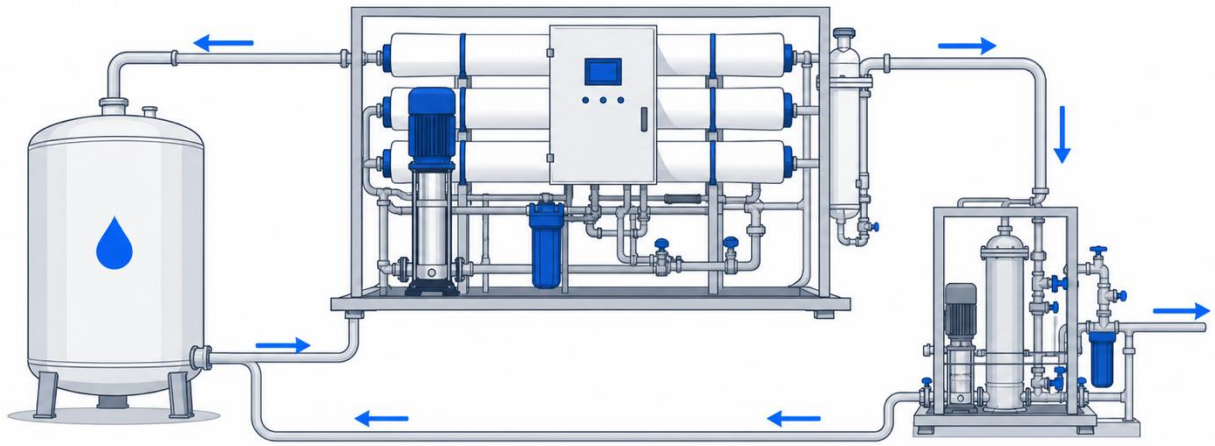
gallons of water reduced

YTD vs. 2025 (as of 7/14/2026)

- Assembly reduced >12,000,000 gallons YTD vs. YTD 2025 simply by installing meters, holding weekly review meetings and taking no cost actions
- Correct team members involved that can take immediate action!
- Unplanned or out-of-spec conditions addressed quickly
- Serves as a replicable model for other GM sites
  - Based on the Water Intelligence program, the team has secured 2027 funding to expand to an additional 17 facilities in North America
  - Program scope includes a 2 year ROI of $1.8 million in water savings across the 17 facilities

Step 2 — RO Reject Recovery: Reclaiming Lost Water

- Every RO system generates reject, pre-flush, and post-flush water that normally goes to a sanitary / process drain — a lost opportunity
- Standard RO systems should operate at a minimum 75% recovery; reject water is reusable “as-is” with caution due to concentrated parameters
- The Reject Recovery RO treats reject water to a quality better than city water, raising overall RO system efficiency to ~89–90%
- Treated water is sent back ahead of the primary RO's or used as cooling tower or other system make-up



Reject stream diverted to a recovery unit; permeate returns ahead of the primary RO's

RO Reject Recovery: The Savings Story

- May 2024 – first standalone RO Reject Recovery (RRO) system installed at Fort Wayne Assembly facility - 11% reduction in total overall system potable-water demand
- Transferable to all locations with an RO unit; roll-out continuing
- ~6 year ROI (Energy is **NOT** water – need alternate ROI's!)
    - $~650k investment in 2024
    - New quotes range from $800k to $1.1M (think barriers!)
    - Minor: energy increase to run unit, anti-scalent, membrane cleaning
- Together with the global reduction of Electro Deposition final-rinse nozzles, this effort helped GM earn a DOE Better Project Award by eliminating approximately 120 million gallons of potable water use annually

Better Plants
U.S. DEPARTMENT OF ENERGY

2025 Better Project

Reverse Osmosis Concentrate Recovery and Paint Facility Rinsing Operations

General Motors Company (GM) has reduced the electrophoretic deposition final rinse water usage by 50% in all its paint shops globally, and installed a reverse osmosis (RO) reject recovery system at its Fort Wayne Assembly facility, eliminating more than 120 million gallons of potable water annually.

- Captured and treated RO reject water for use as make-up source for cooling tower or primary RO units
- Implemented RO reject recovery system at Fort Wayne Assembly facility that is transferable across all GM paint shop facilities with an RO unit
- Ensured reduction of RO rinsing volumes without compromising paint quality

Step 3 — The Treasure Hunt Process

- Energy Treasure Hunt completion within GM for many years, minor water component included
- Created stand alone Water Treasure Hunt with dedicated Subject Matter Expert (SME) participation in 2025, including best practices, ECO Toolbox
- Focus: tighten control of water-consuming systems and actively identify reuse / recycle opportunities (RO recovery, cooling-tower cycles, reuse of “wastewater” into process, leak repair, reduced paint rinse sprays)
- Energy Treasure Hunt resource, align to water: Energy Treasure Hunts | Better Buildings & Better Plants Initiative

Step 3 — The Water Treasure Hunt Process

- Data prep: site water balance, wastewater discharge reports, cooling-tower & RO service reports, source water quality
- Travel and tour the facility with site owners/engaged personnel
- Seek to understand, NOT audit!
- Dive into potential savings opportunities, present to Leadership and implement
- Methodology validated through stakeholder review; standardized for repeatable use across sites

Treasure Hunts Turn Insight Into Reuse Opportunities

Facility Example #1

500,000 m^3 +

Total short-term implementable water savings identified (~17,305 m^3 near-term)

Facility Example #2

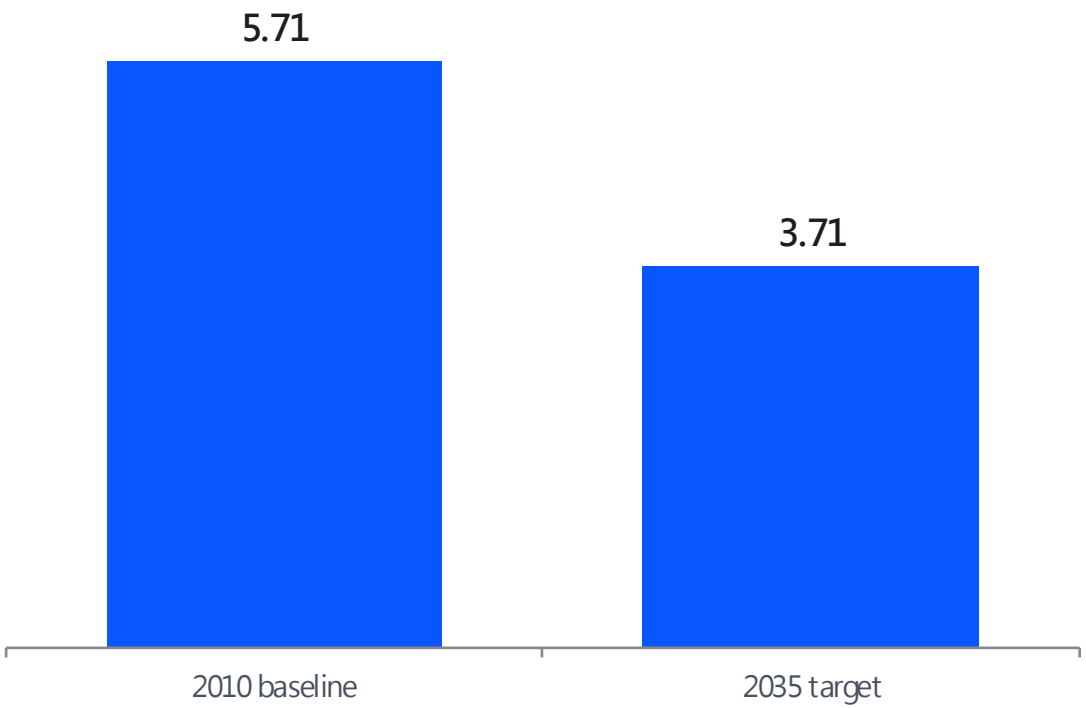
93,153 m^3

~$397,731 in opportunities (~25–35% efficiency improvement)

- Sites prioritized by above-average water consumption or intensity
- Largest roadblock tends to be the lack of metering

The Integrated Value: Offsetting Millions of Gallons Annually

Water Intensity Glidepath (m^3/unit)



35% reduction target by 2035 vs. 2010 baseline

Measure

Water Monitoring programs = engagement!

Recover

Why can't we use water more than once versus sending to drain?

Reuse & Replicate

Treasure Hunts
Sharing what works and what does not = innovation!

One connected system: metering finds it, recovery equipment captures it, Treasure Hunts scale it — advancing toward water conservation

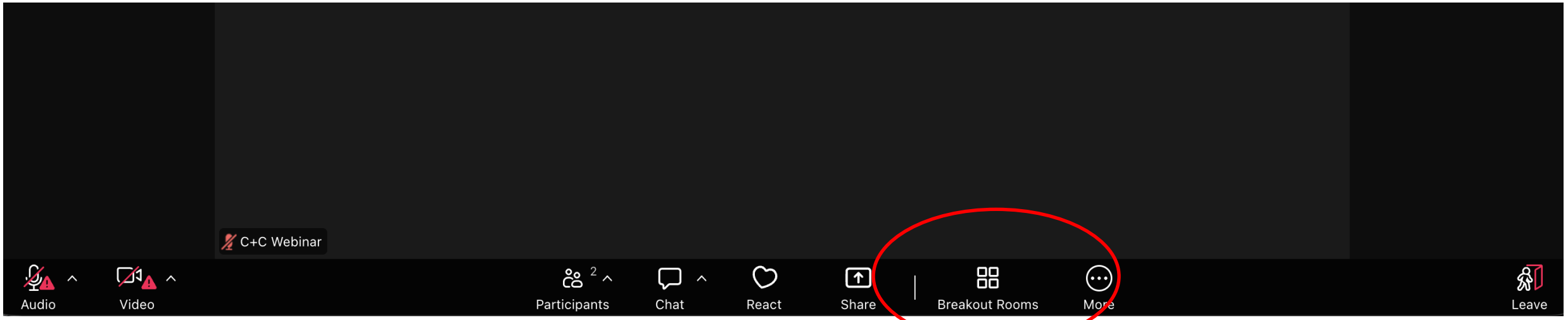
Q & A

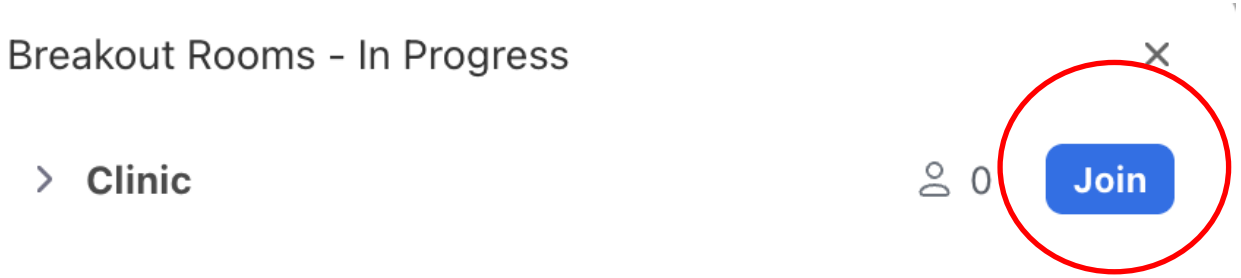
Submit Questions
www.slido.com event code **#WaterReuse**

Clinic

If interested in discussion with speakers, please stay on and join the breakout room.

Join the Clinic Breakout Room





Welcome to the Industrial Water Reuse Clinic!

Goals: Provide a forum for

- Deeper Q&A with guest speakers
- Q&A with other webinar participants
- Peer-to-peer discussions about specific subjects

Chatham House Rules

- **What you can do:** You can share the ideas, facts, and lessons learned during the meeting with people outside the room
- **What you cannot do:** You cannot say who spoke, what group or company they work for, or name any other person who was at the meeting

This portion of the webinar is not recorded