

A large teal arc graphic that starts from the left edge of the slide and curves downwards towards the right, framing the main title.

Implementing Water Circularity for Communities and Industries

September 2023

Speakers



**Vijay
Sundaram**, Ph.D., P.E.
**Vice President, Global
One Water Director**

- 20 years of experience applying potable water reuse solutions
- Research in technology development and application of advanced treatment processes for indirect and direct potable reuse



**Lucy
Pugh**, P.E., BCEE
**Vice President, Global
Industrial Water Practice
Director**

- 35+ years of experience in industrial wastewater treatment and reuse

Every day in the United States:



 **34B**

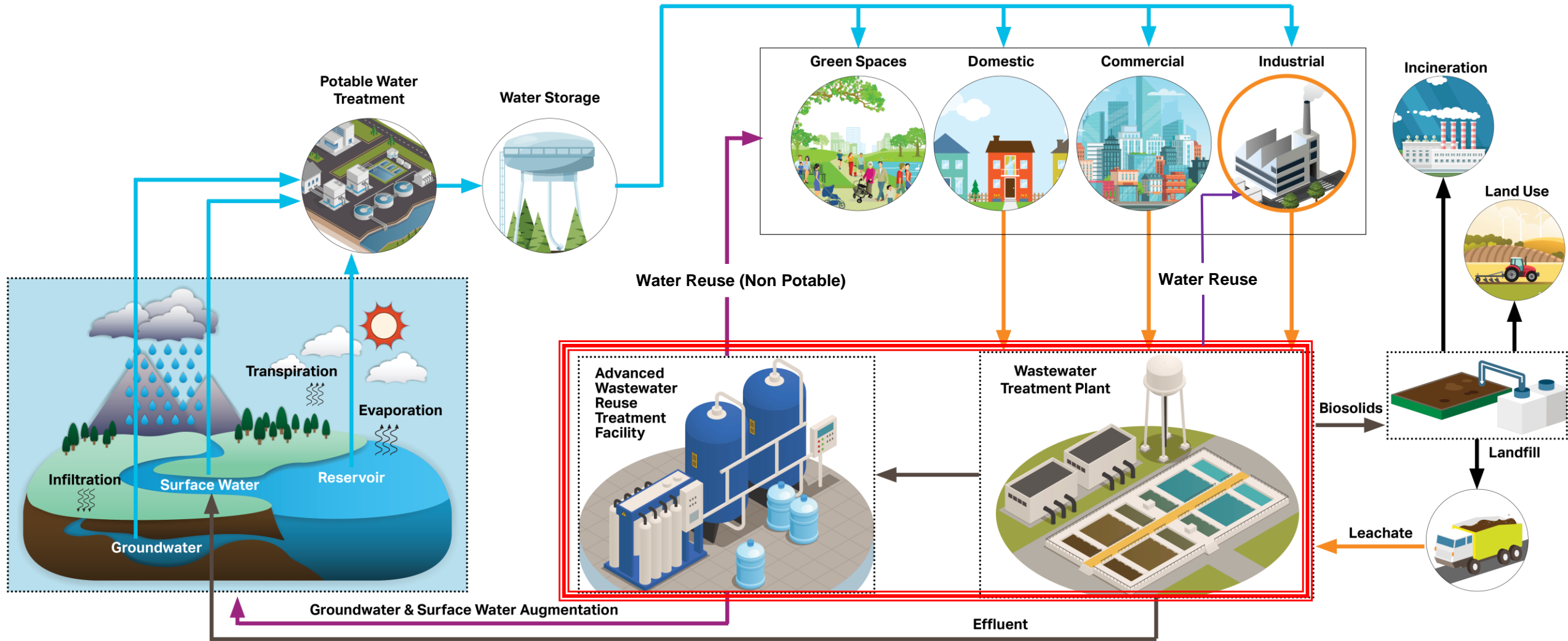
34 billion gallons of potable water are treated at an annual cost of **\$19 billion***



 **36B**

36 billion gallons of wastewater are treated at an annual cost of **\$23 billion***

The One Water Cycle



Agenda

Potable Reuse

Drivers

Types and Treatment
Trains

Case studies

Water Reuse for Industry

Drivers

WRF Effluent Reuse
Industrial Effluent Reuse

Case studies

Impediments

What is preventing
widespread
implementation of
water reuse?

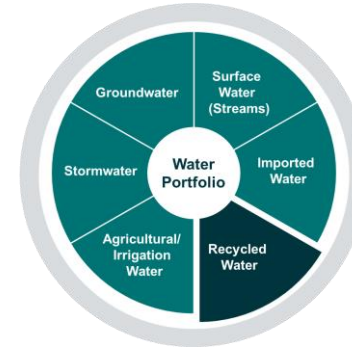
Water Reuse for Communities

Holistic Benefits of Reuse and One Water Planning & Implementation



Economic Development and Urbanization

Recycled water can be a best-value proposition for providing a lower-cost water than alternatives



Water Portfolio Diversification and Resiliency

Provide multiple sources for reliability and in case of degradation of a single source



Comprehensive Effluent, Nutrient, and PFAS Management

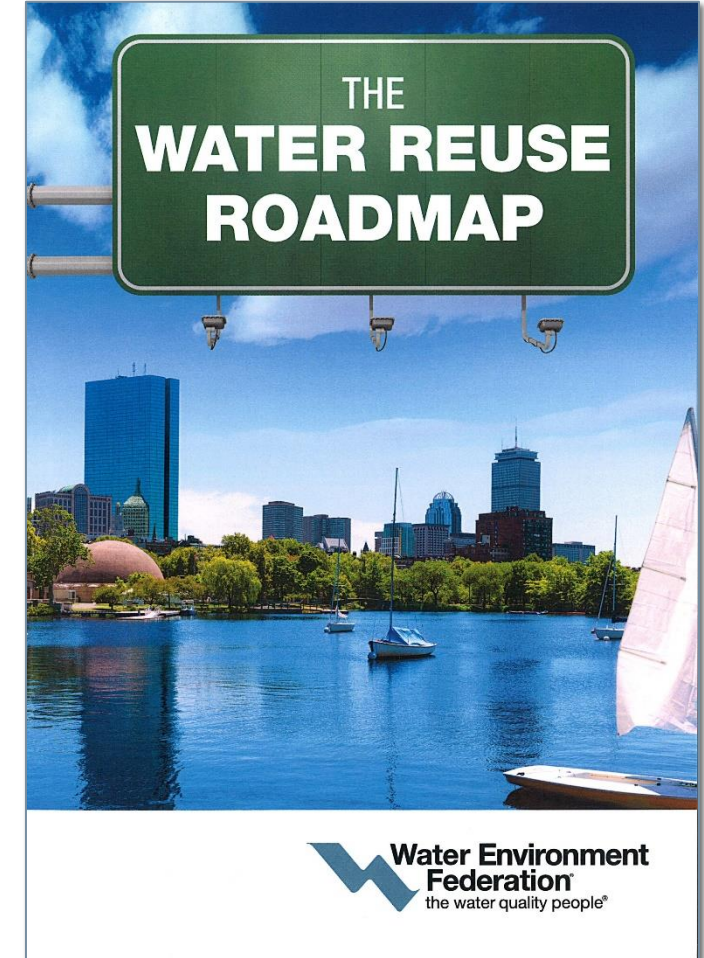
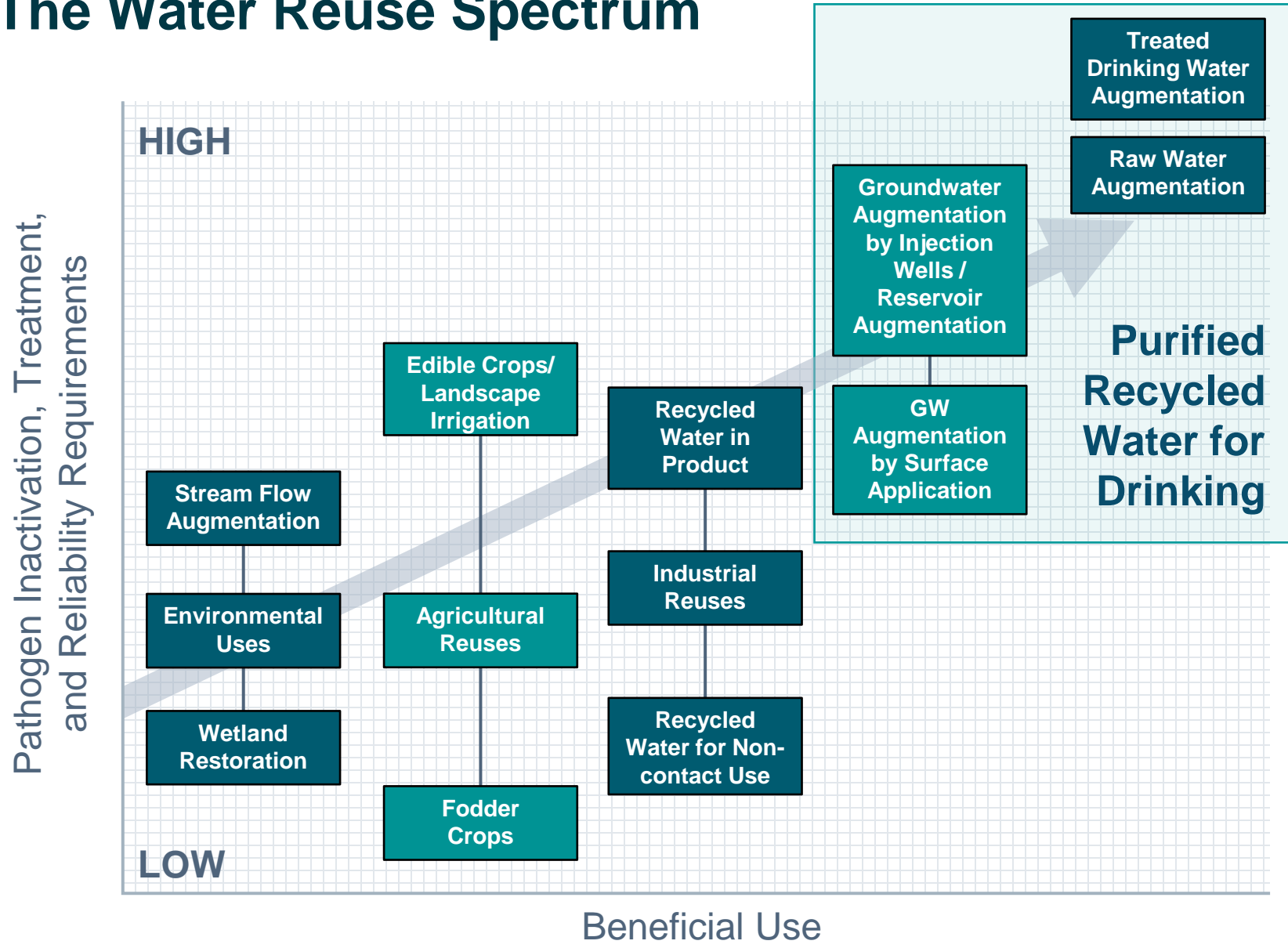
Investment dollars are being diverted from advanced wastewater treatment to water reuse



Climate Change Adaptation

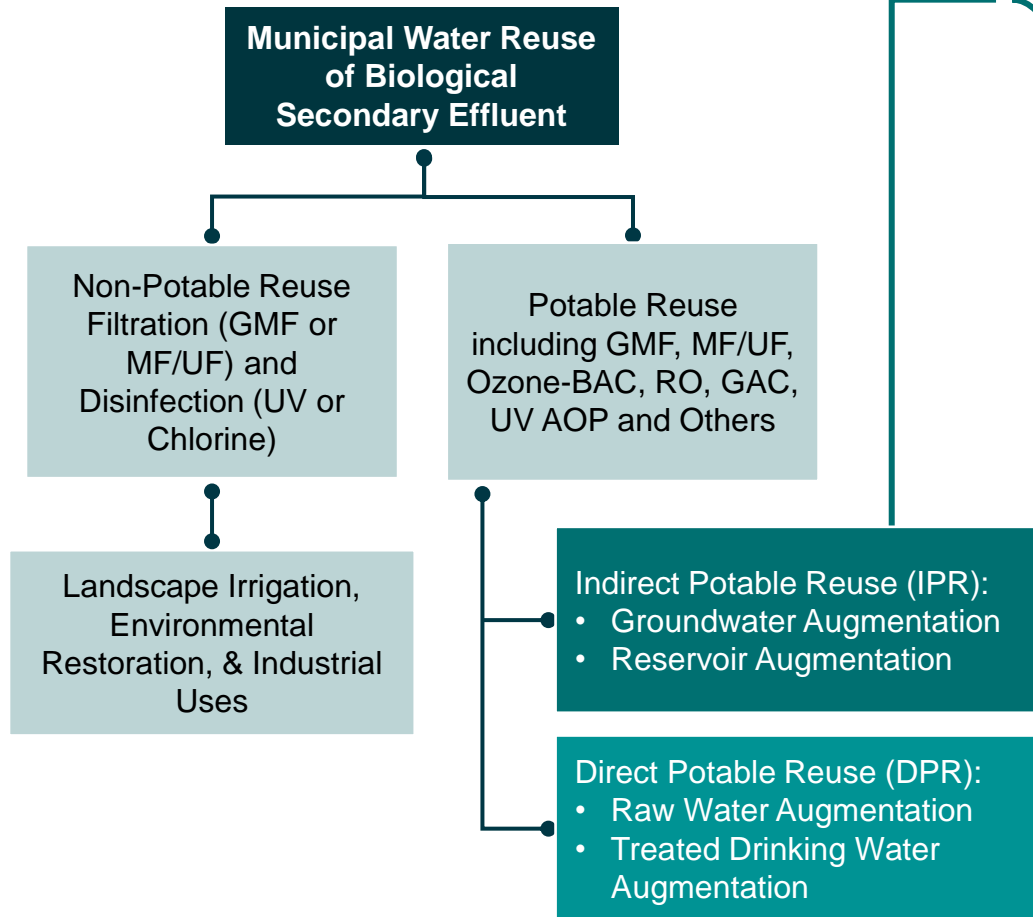
Address land subsidence by restoring groundwater levels & mitigate seawater intrusion

The Water Reuse Spectrum



Source: The WEF Water Reuse Roadmap, 2018

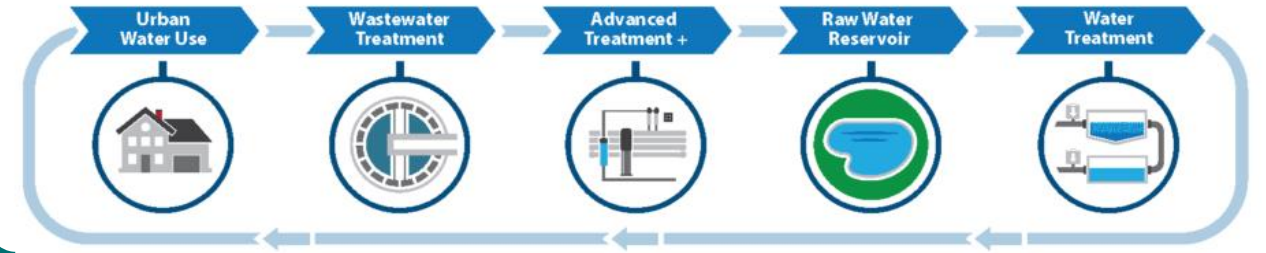
Recycled Water Types and Terminologies



1. Groundwater Augmentation



2. Reservoir Water Augmentation



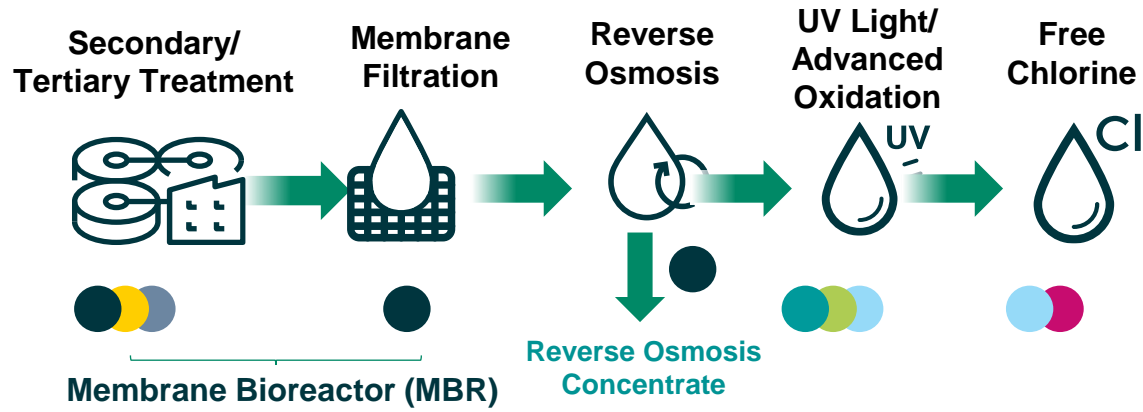
3. Raw Water Augmentation



4. Treated Drinking Water Augmentation



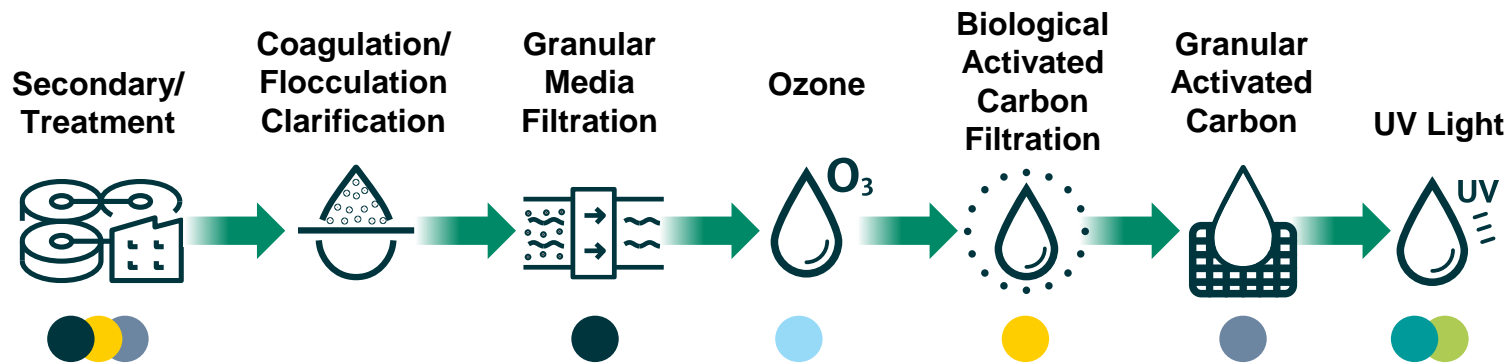
RO-Based Advanced Purification Train



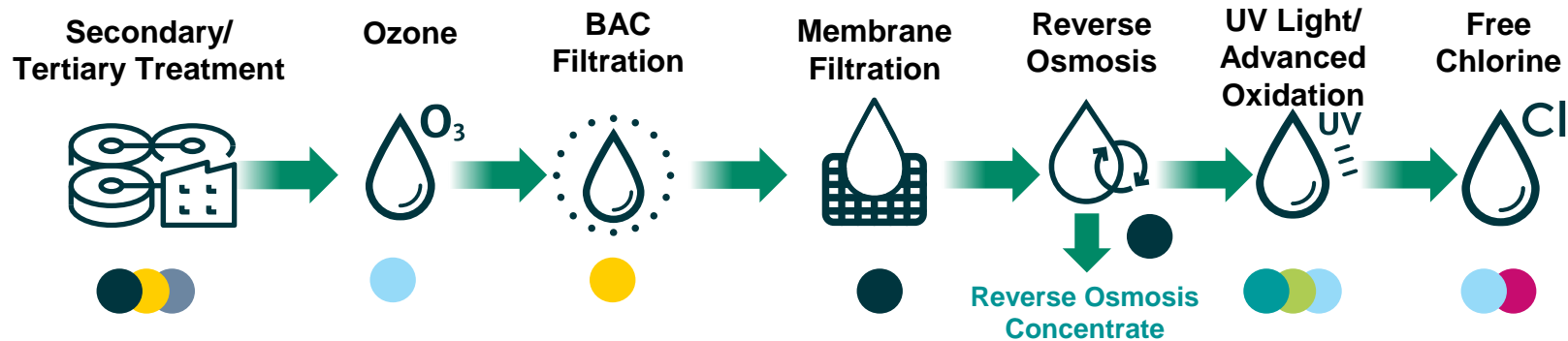
LEGEND

- Physical Removal
- Biological
- Adsorption
- Oxidation
- Chemical Inactivation
- UV Light Inactivation
- Physical Degradation

Carbon-Based Advanced Purification Train



Potential Future California Direct Potable Reuse (DPR) Advanced Purification Train



Community Water Reuse Case Studies

Hampton Roads Sanitation District (HRSD), VA SWIFT Program

The Sustainable Water Initiative for Tomorrow (SWIFT) Program includes new SWIFT facilities at multiple WWTPs and a complex series of treatment plant upgrades.

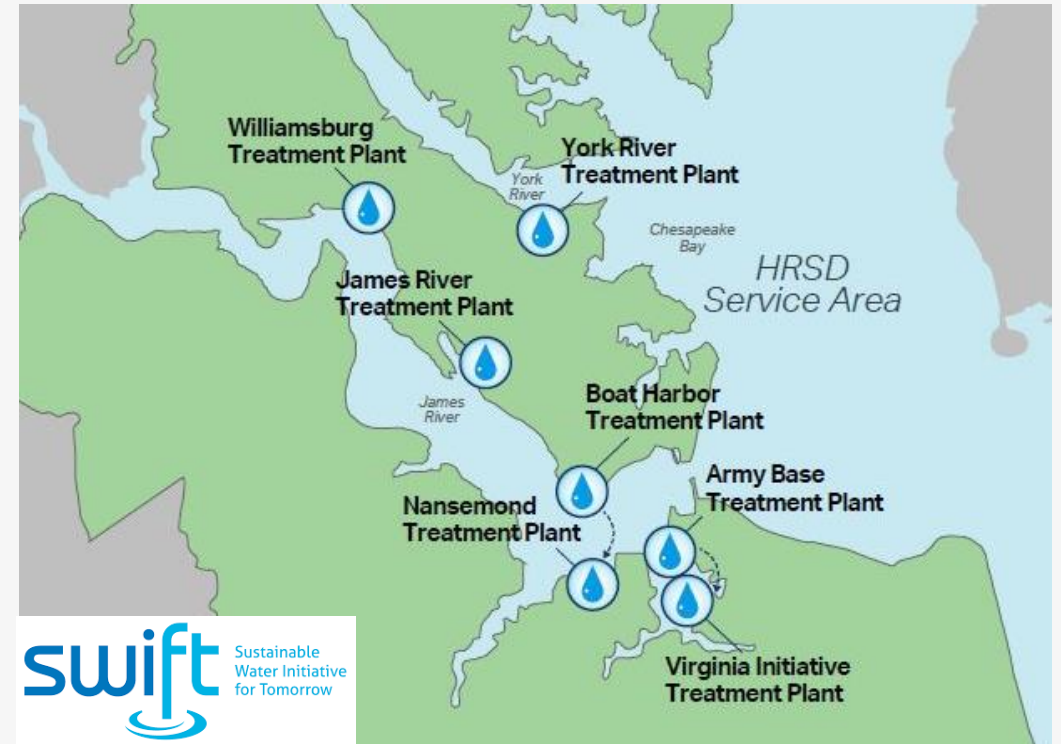
SWIFT Program has received \$1B in WIFIA low-interest loans from EPA (two installments).

Up to
100
mgd

\$2.1
billion dollars

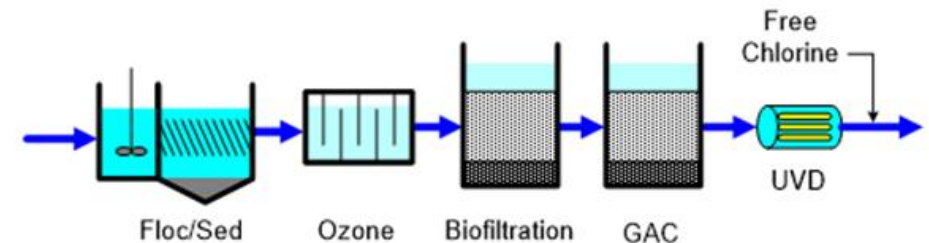
33
discrete
projects

More information can be found here: <https://www.hrsd.com/swift>

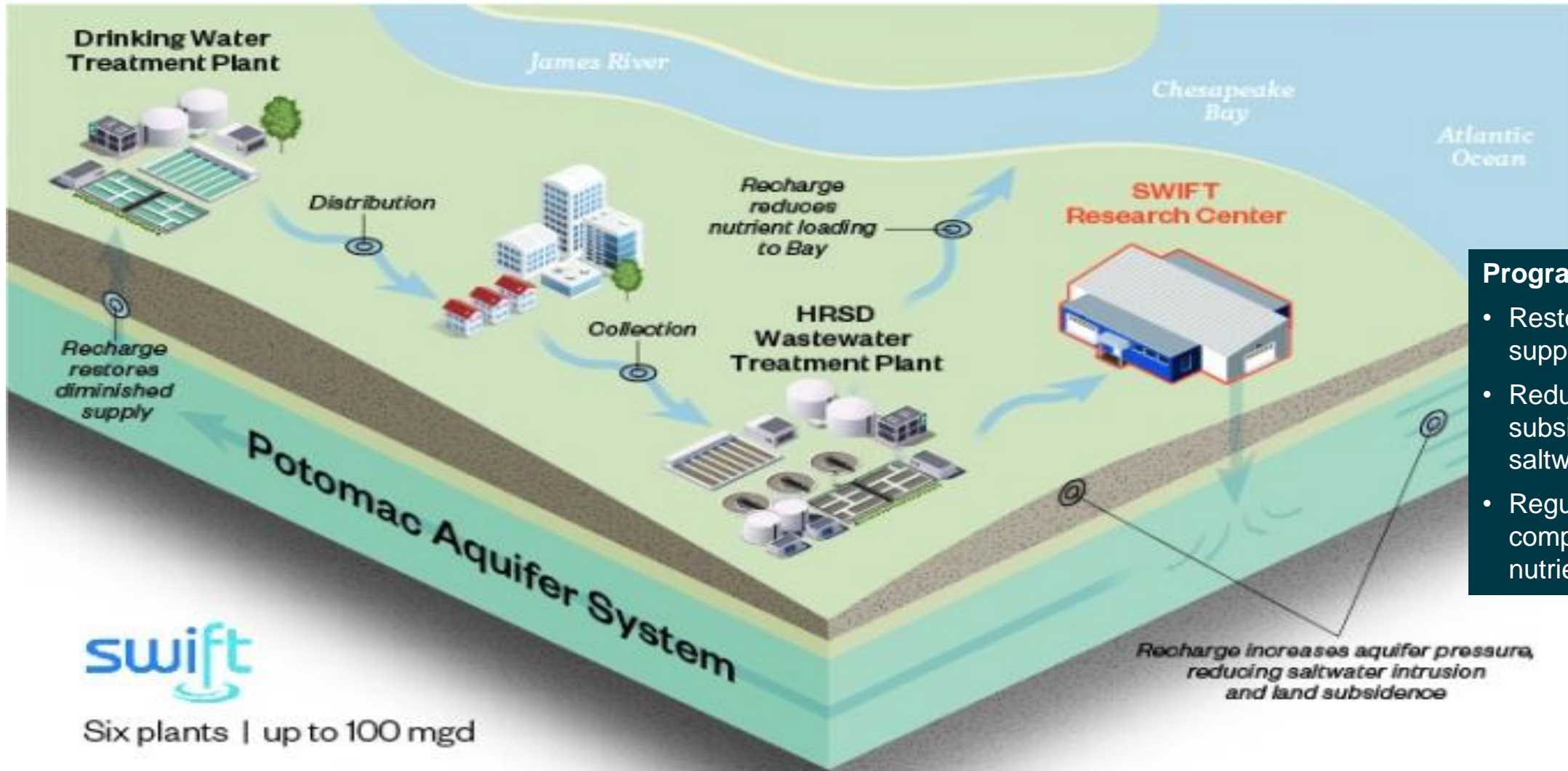


The SWIFT Program involves up to seven WWTPs.

Carbon-Based Advanced Purification Train



HRSD – SWIFT Program Overview, VA

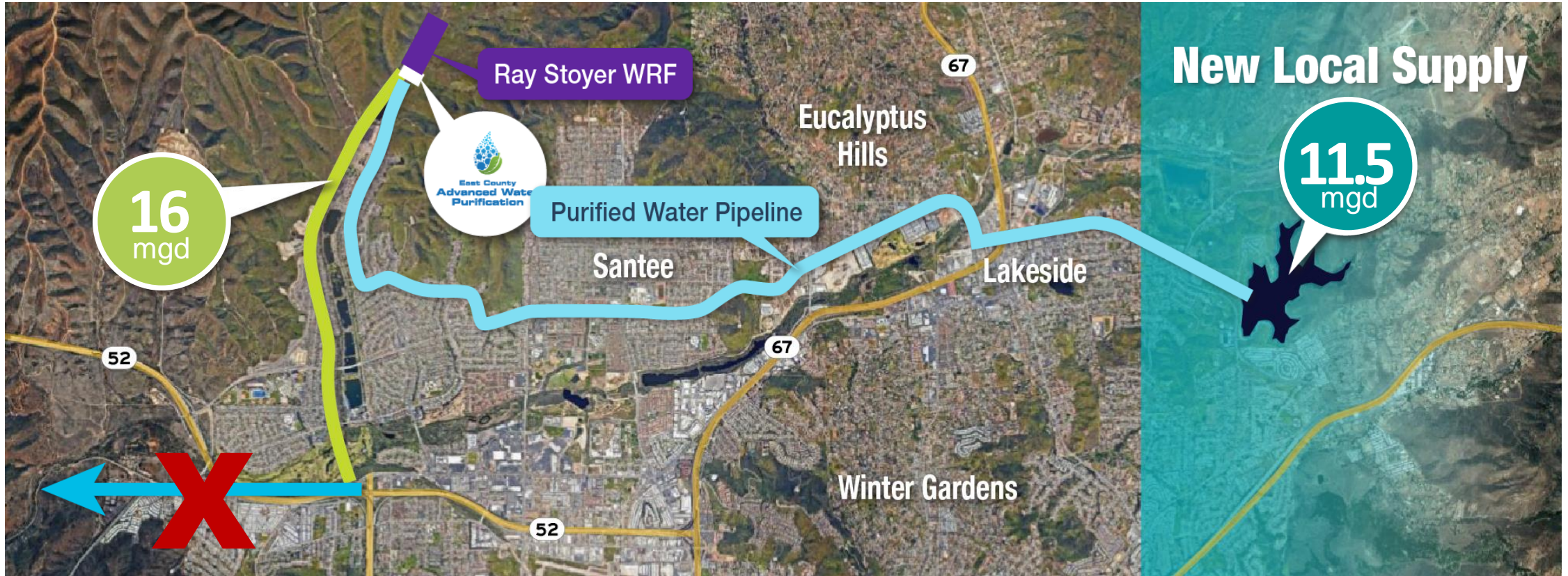





Program Benefits:

- Restore groundwater supply
- Reduce land subsidence and saltwater intrusion
- Regulatory compliance: Reduce nutrient loading to Bay

More information can be found here: <https://www.hrsd.com/swift>

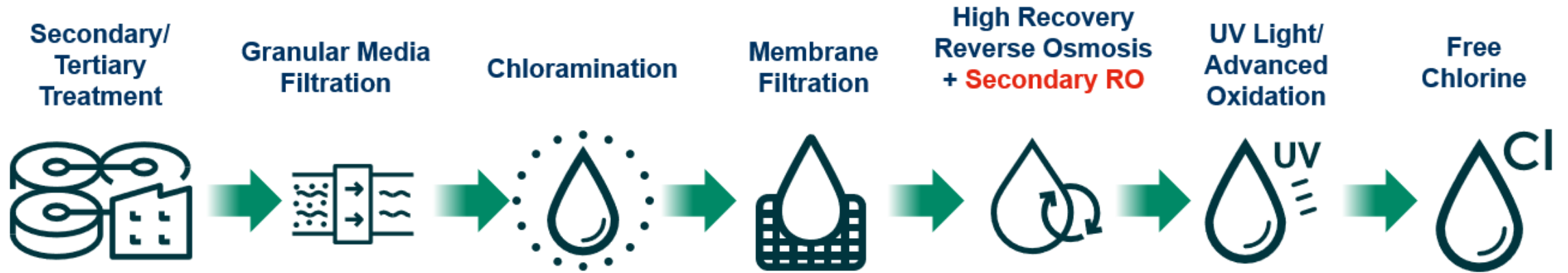
East County Advanced Water Purification JPA, Santee, CA



 <p>Reduce the region's DEPENDENCE on imported water</p>	 <p>Provide up to 30% of East County's DRINKING WATER demand</p>	 <p>Create a NEW, LOCAL, Sustainable + Drought-proof drinking water SUPPLY</p>
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East County AWP JPA, Santee, CA

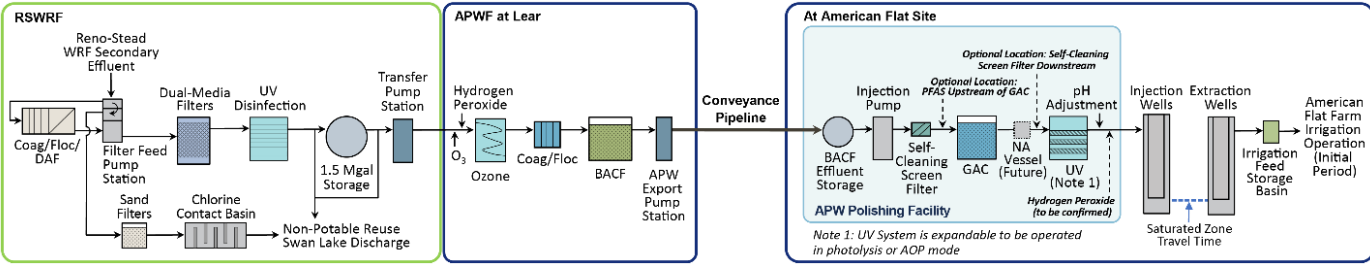
- Design of secondary treatment to generate a source water suitable for potable reuse
- High-recovery RO - 95% Overall Water Recovery - Use of Closed-Circuit Reverse Osmosis (CCRO)



Truckee Meadows Water Authority and City of Reno, Reno, NV OneWater Nevada Advanced Purified Water Facility Project



- Project Benefits:**
- Groundwater recharge/water banking
 - Habitat protection
 - Flood mitigation



More information can be found here: <https://onewaternevada.com/>

The Metropolitan Water District of Southern California

Pure Water Southern California Program

Pure Water Southern California in Numbers



Would produce up to **150 million gallons** daily, enough water for about 500,000 homes



One of the largest programs of its kind in the world



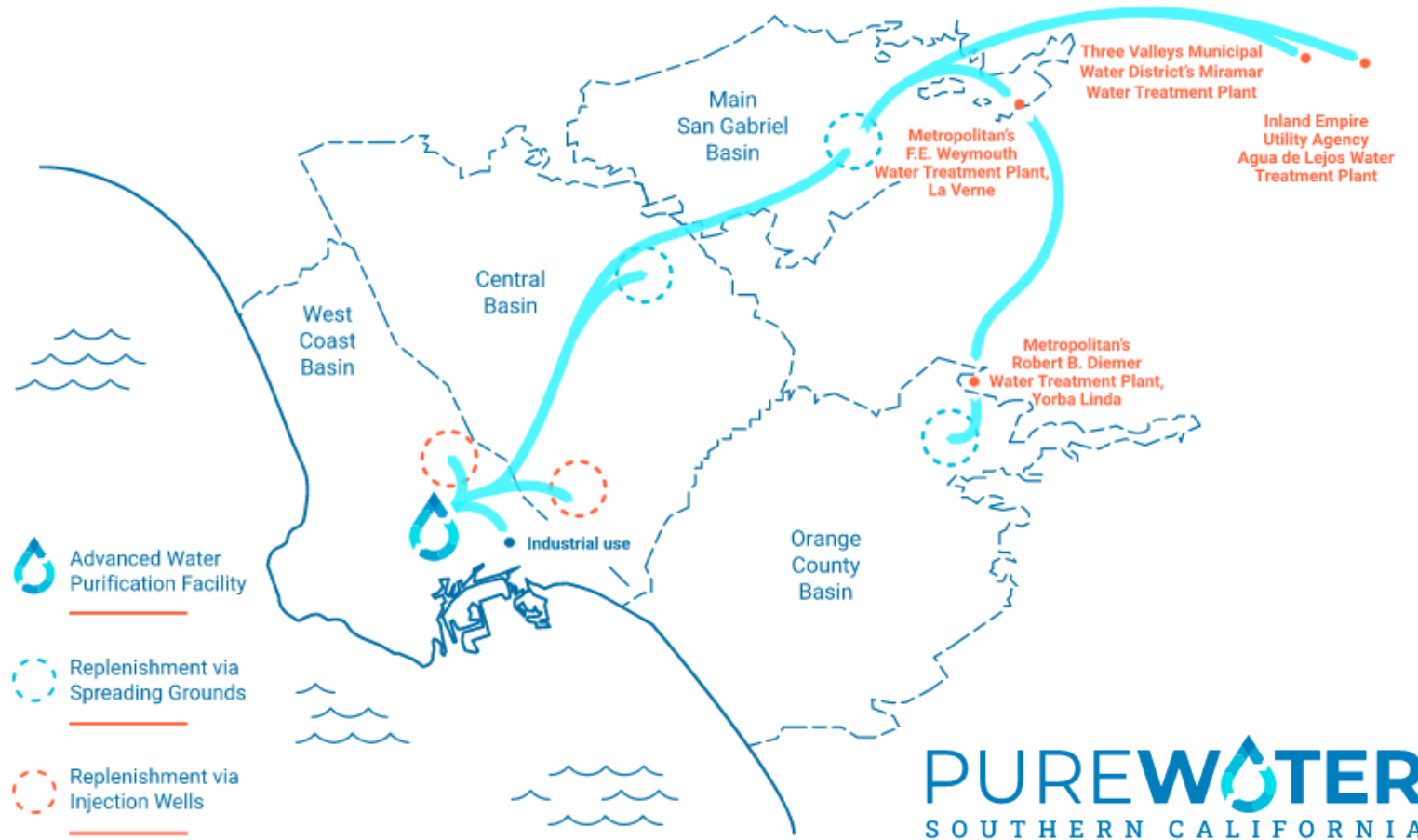
More than **15 program partners** and hundreds of program supporters



A new source of water for up to **15 million people**



Nearly **\$100 million** in grant and partnership funds secured



More information can be found here: <https://www.mwdh2o.com/building-local-supplies/pure-water-southern-california/>

Water Reuse for Industry

Drivers for Industrial Water Reuse

- Water stewardship; reduce water footprint
- Water scarcity
- Resiliency
- Stringent effluent discharge requirements



How Does Industry Use Water?

Utilities

- Steam generation
- Cooling

Process water

- Water that becomes part of the product
- Water that contacts the product

Cleaning water

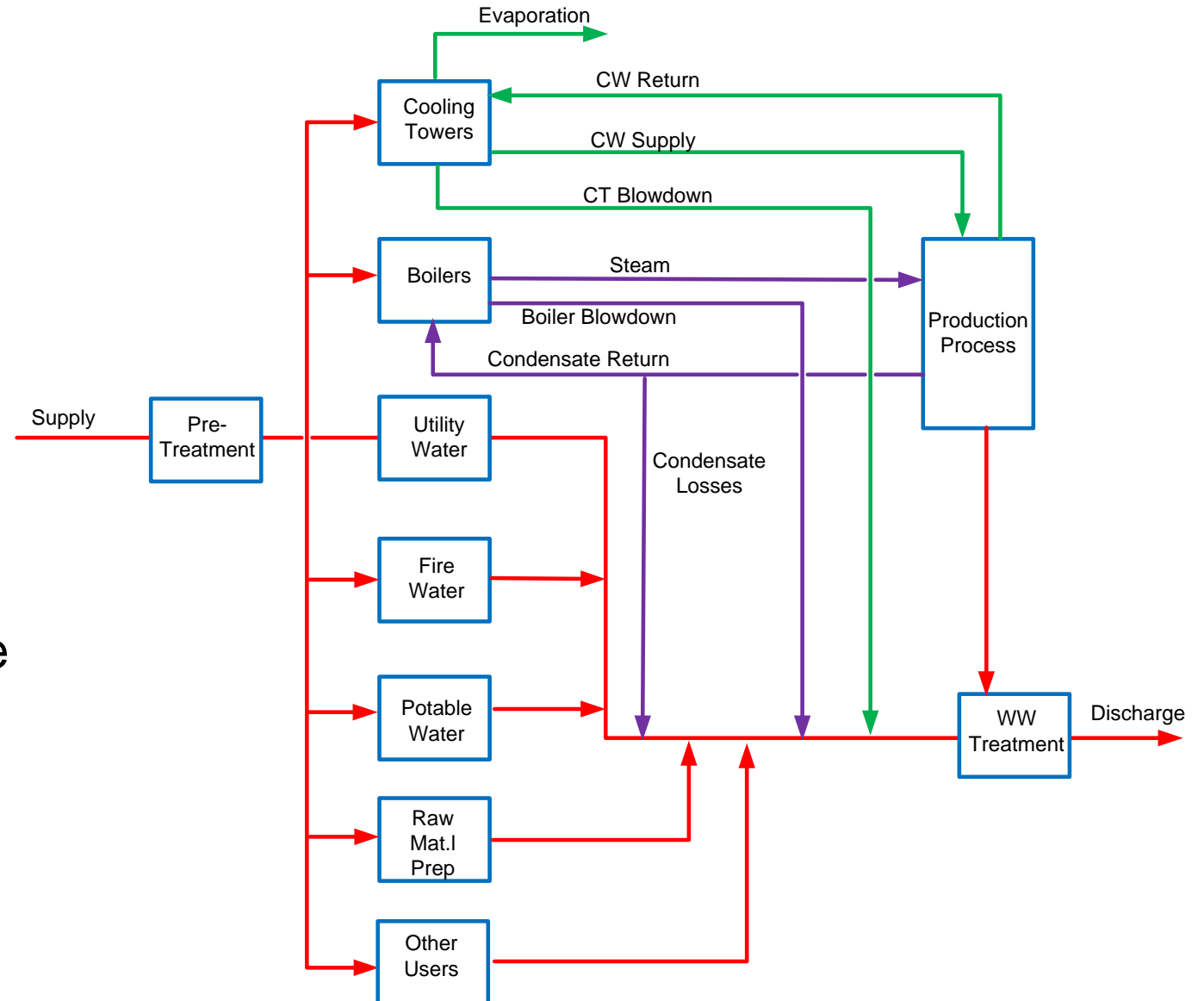
- Equipment cleaning
- Sanitization



Where to Start

Define facility water balance and required water quality

- Identify most significant water-using processes.
- Water quality requirements may vary substantially among water uses.
- Pretreatment systems may already be in place for some water uses.



Municipal WRF Effluent Reuse

May be a good option when:

- WRF produces enough effluent to supply most or all of industry's water needs
- Industrial facility is located close to the WRF
- WRF effluent quality meets industry's requirements



Potential Impacts of WRF Effluent Reuse to Industry's Operations

- Reject / waste streams from process water treatment process
- Cooling tower chemistry and blowdown rate
- Industrial wastewater effluent characteristics
 - Concentration of microconstituents
 - Concentration of other regulated constituents



Additional Considerations for WRF Effluent Reuse for Industrial Operations

- WRF process upsets; variability in effluent characteristics
- WRF ability to accept industry's wastewater
- Financial
 - Who pays for capital investment?
 - Fee structure
 - Take-or-pay agreement
- Collaboration is critical
- Public perception



Industrial Water Reuse

May be a good option when:

- Increased resiliency needed in water-scarce regions
- Existing wastewater treatment system already produces high-quality effluent
- Opportunities exist for point-of-use recycle
- Stringent effluent discharge requirements drive use of advanced treatment processes



Industrial Water Reuse

Point-of-use water recycling

- Opportunity to recover water and chemicals

Combined effluent recycling

- Quantity and quality produced
- Quantity and quality needed for candidate water users
- Define wastewater treatment requirements
 - Organics
 - Inorganics that can cause scale formation
 - Salts



Technologies Used for Industrial Reuse

Most industrial facilities already treat or pretreat their wastewater to high quality standards.

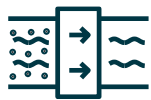
Example Treatment for Discharge

Example Treatment for Reuse (with Total Dissolved Solids Control)

Coagulation/
Flocculation
Clarification



Filtration



Coagulation/
Flocculation
Clarification



Membrane
Filtration



Reverse
Osmosis



Microbial
Control



Reverse Osmosis
Concentrate

Biological
Treatment



Coagulation/
Flocculation
Clarification



Filtration



Biological
Treatment



Membrane
Filtration



Reverse
Osmosis



Microbial
Control



Reverse Osmosis
Concentrate

Membrane Bioreactor (MBR)

Additional Considerations for Industrial Water Reuse

- Concentrated waste stream handling and disposal
- Reuse water storage
- Microbial control
- Backup water supply



Industrial Water Reuse Case Studies

Power Plant

- 4 mgd WRF effluent reuse for power plant cooling towers
- 1 mgd blowdown back to WRF
- Infrastructure requirements
 - 4 mgd pumping station with supplemental chlorine dosing
 - 3.5 mile, 16" diameter force main
 - 0.7 mile, 20" diameter sanitary sewer
 - Motorized valves at the WRF chlorine contact tank allow remote operation by the power plant
 - Clarification and filtration at the power plant



Food Processing Facility

- 28,000 hogs per week slaughter facility
- Reuse driven by regional water scarcity
- Wastewater contains high strength organics, nitrogen and phosphorus
- Treatment train
 - Screening
 - Dissolved air flotation
 - Membrane bioreactor
 - Effluent cooling
 - UV disinfection
 - Reverse osmosis
- Produces 130,000 gpd of water used in cooling towers and truck washing



Summary

Impediments

Cost

- High initial investments
- Assess benefits of water reuse projects beyond costs

Public perception and acceptance

- Potable reuse and in-product reuse

Regulatory framework

- Emerging contaminants (e.g., PFAS)
- Lack of standardized / proven agreements
- Potable reuse rulemaking is in progress in several states

Q&A

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