

Regional and National Updates for **Direct Potable Reuse**

Presented by Danny Murphy. Authored by Andy Salveson.

Many thanks to Clean Water Services



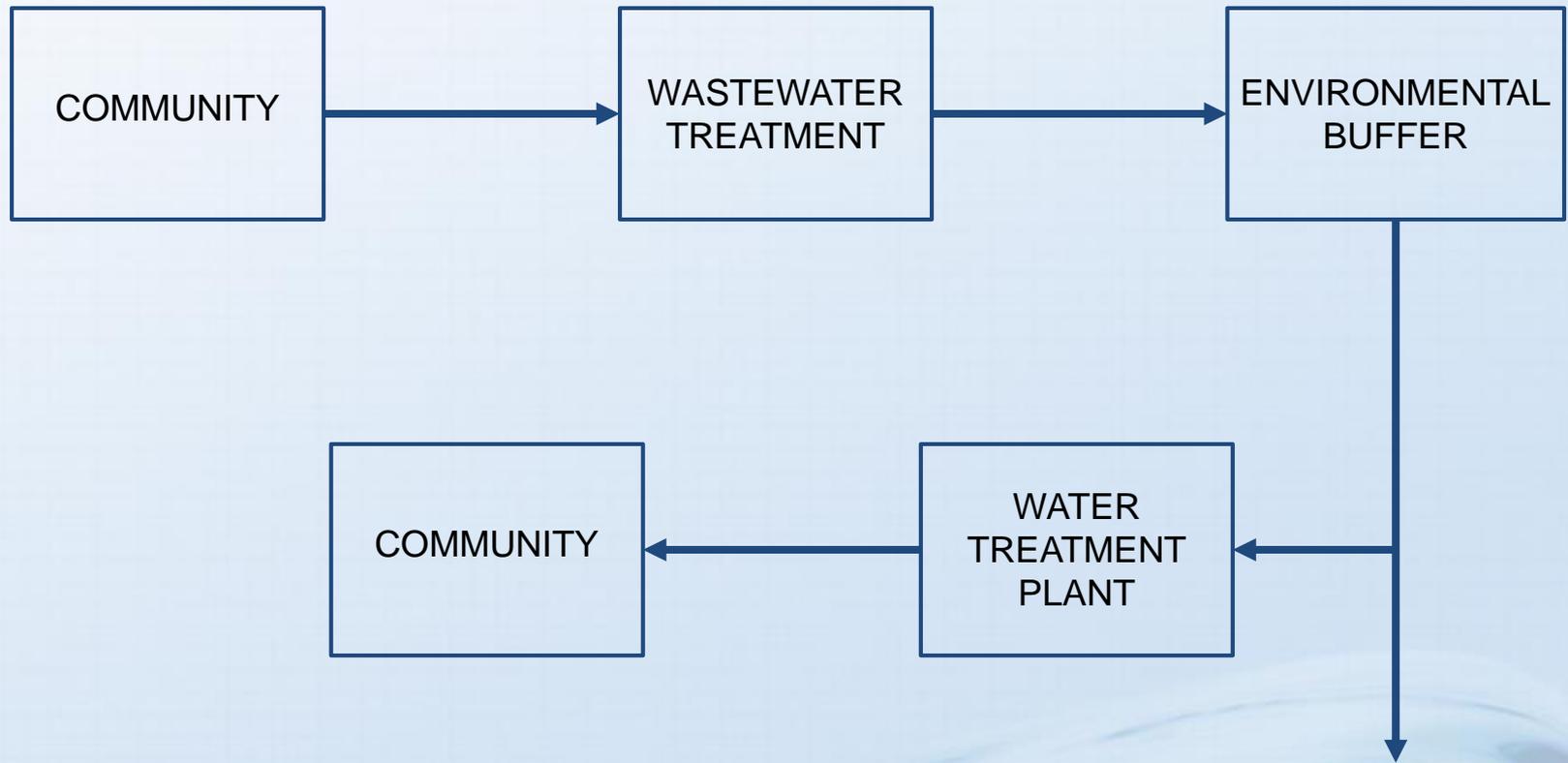
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Overview

- **Background**
- **California** – WaterReuse DPR Initiative
 - Ventura County Demonstration Plant
- **Texas** – Big Spring
- **Oregon** – Clean Water Services Demonstration Plant
- **National** – DPR Framework

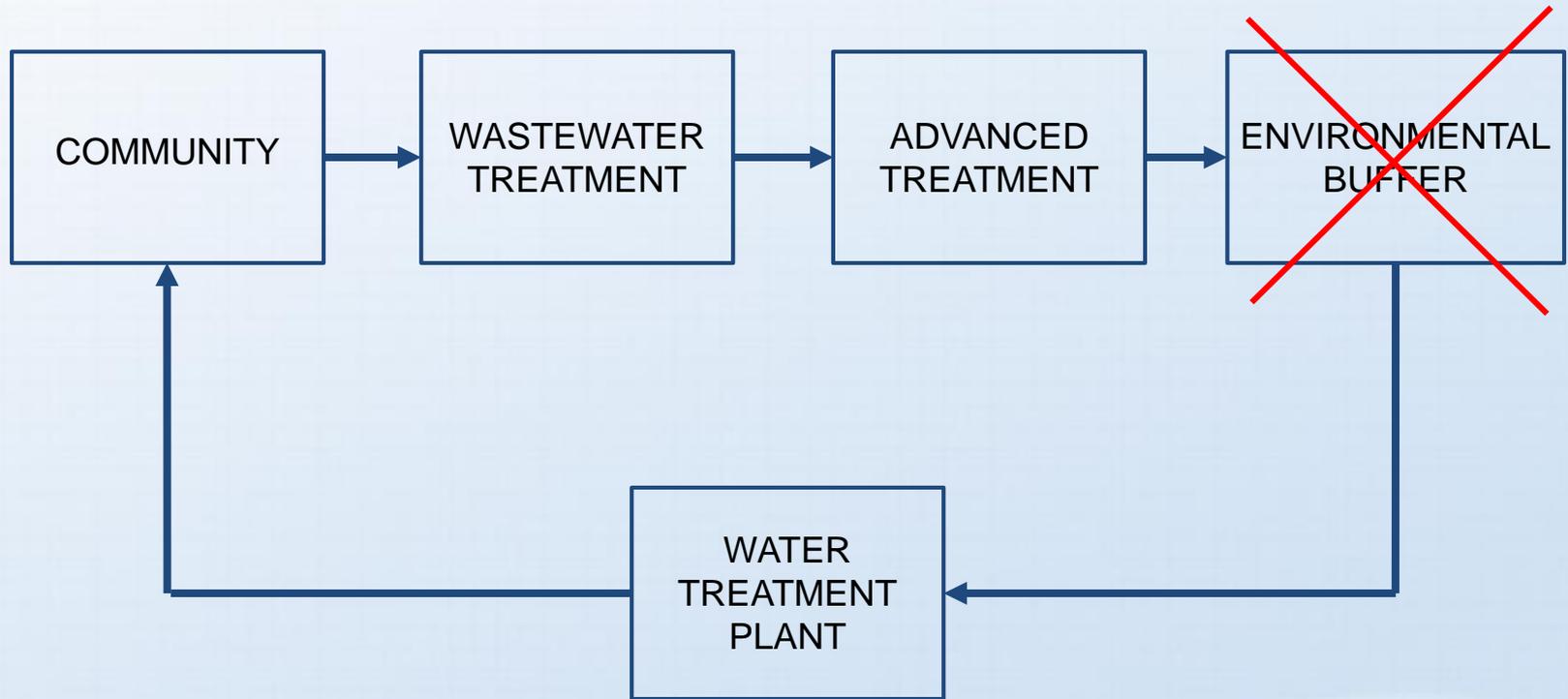
Background

De Facto Reuse (unplanned)



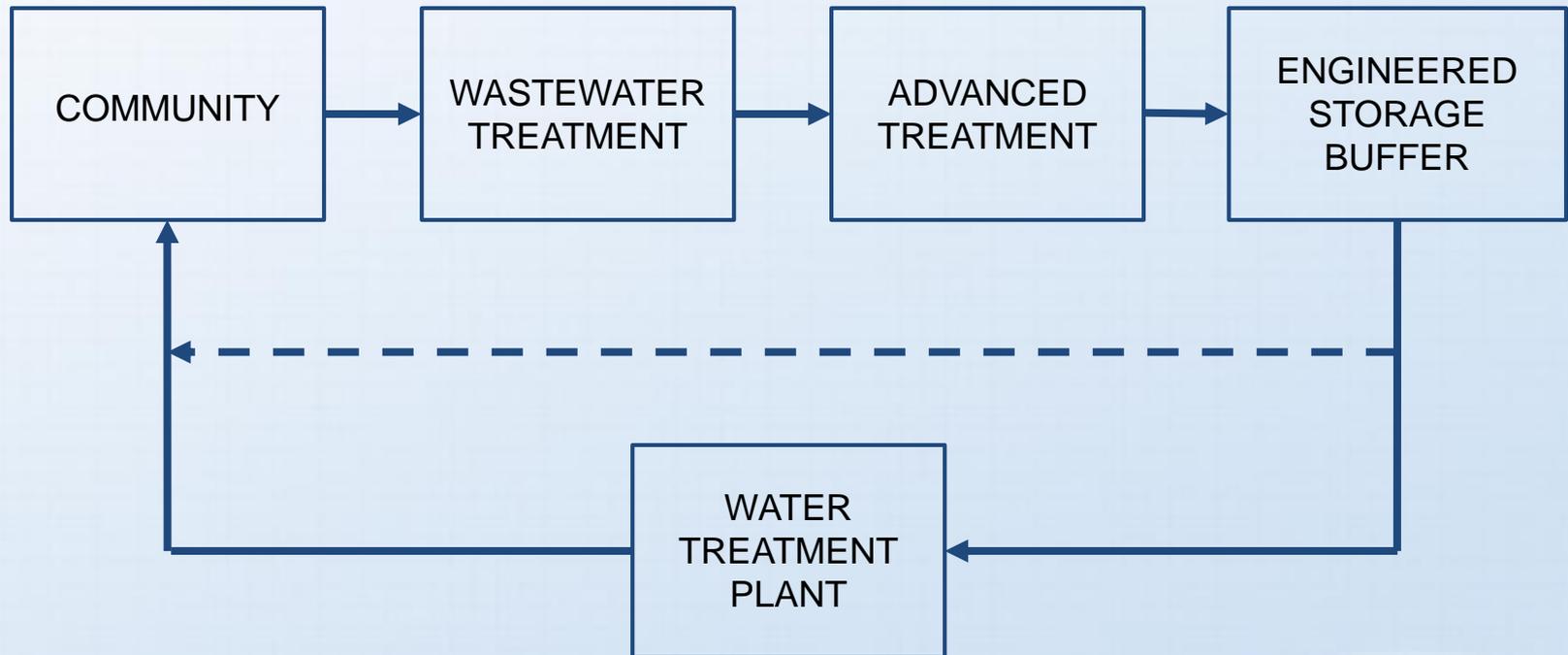
Background

Indirect Potable Reuse



Background

Direct Potable Reuse



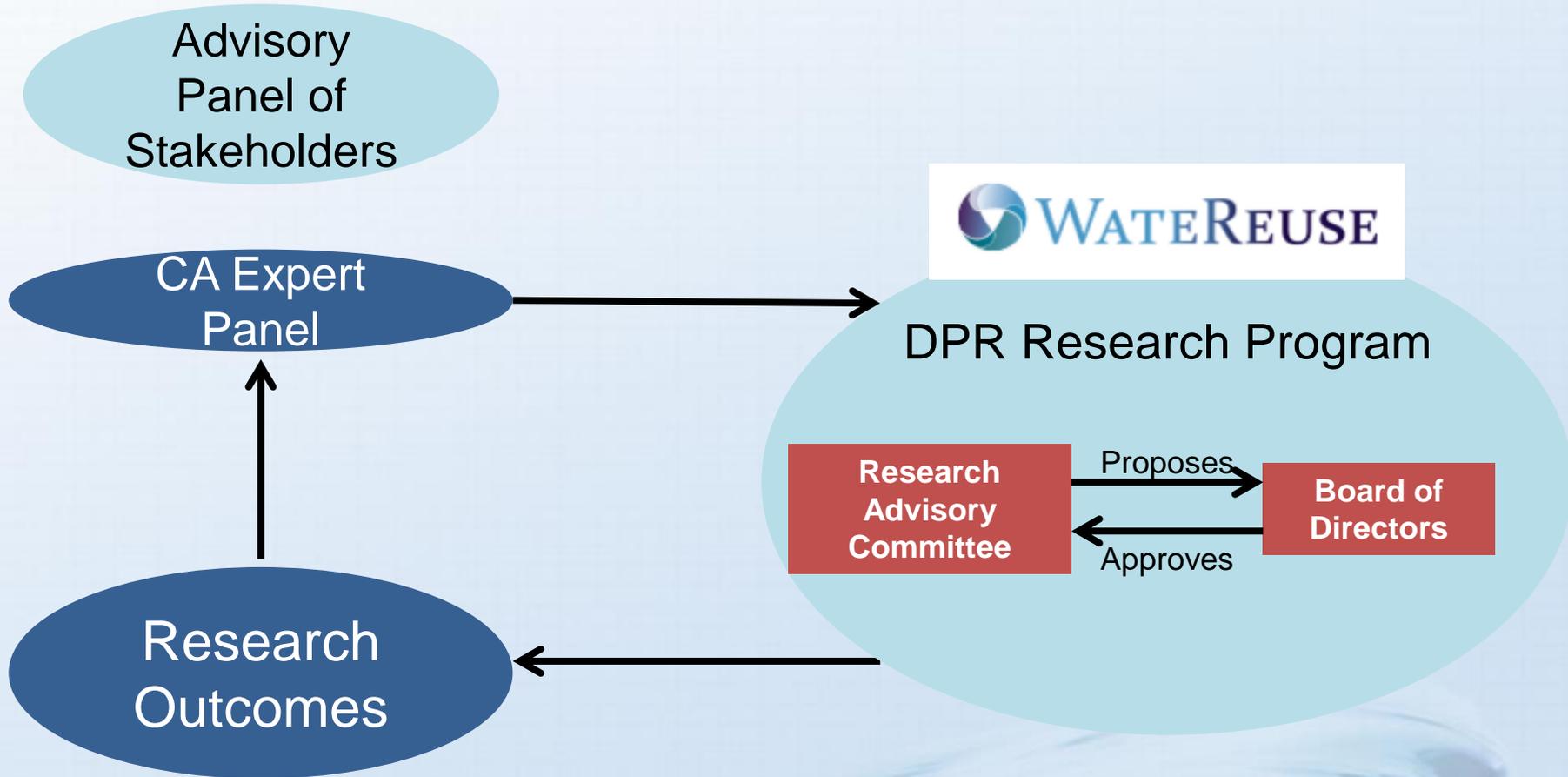
Example IPR / DRP Projects



-  IPR Project
-  IPR Demonstration
-  DRP Project
-  DRP Demonstration

California

California DPR Initiative



Results anticipated to be similar to DPR Framework

City of Ventura



- Limited local water supply
- Consent Decree to divert wastewater

Pasteurization

MF

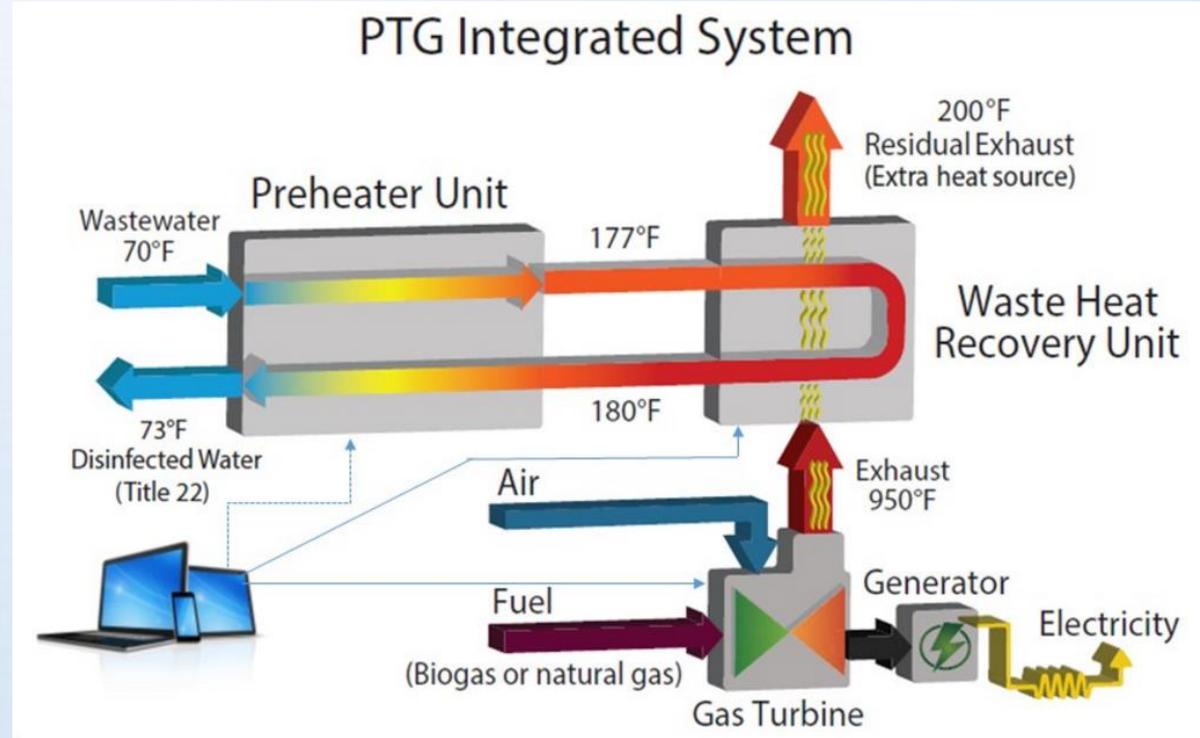
RO

UV/AOP

VenturaWaterPure Demonstration Facility



Advanced Processes Installed to Provide Reliable Water Purification



Source: PTG Water and Energy

Pasteurization provides 5+ LRV of all known pathogens

Advanced Processes Installed to Provide Reliable Water Purification



***UF/RO/UV
AOP
provides
multiple
barriers to
both
pollutants
and
pathogens***

Water Quality Results Show High Quality Water that is Protective of Public Health

Date Collected		10/21/2015	10/21/2015	11/17/2015	11/17/2015	12/1/2015	12/1/2015	12/7/2015
Location	Units	Finished	Finished	Finished	Finished	Finished	Finished	Finished
Gemfibrozil	ng/L	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Naproxen	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Triclosan	ng/L	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ibuprofen	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acetaminophen	ng/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Sucralose	ng/L	< 25	< 25	< 25	< 25	< 25	< 25	< 25
Triclocarban	ng/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sulfamethoxazole	ng/L	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Atenolol	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trimethoprim	ng/L	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Caffeine	ng/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Fluoxetine	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Meprobamate	ng/L	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Carbamazepine	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Primidone	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
DEET	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	1.6	< 1.0	< 1.0
TCEP	ng/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10
PFBA	ng/L	< 5.0	< 5.0	< 5.0	< 5.0	11	< 5.0	< 5.0
PFHxS	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFHxA	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFOA	ng/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
PFOS	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFNA	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFDA	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFUdA	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFDaA	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PFPnA	ng/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PFHpA	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Estrone	ng/L	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Estradiol	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Ethinylestradiol	ng/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Testosterone	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Progesterone	ng/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50

Advanced Monitoring and Innovative Treatment Demonstrated in Ventura



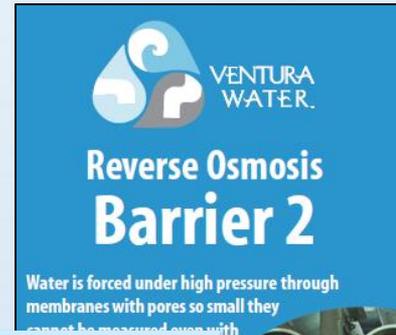
Public Acceptance

<http://www.cityofventura.net/water/sustainable-water>

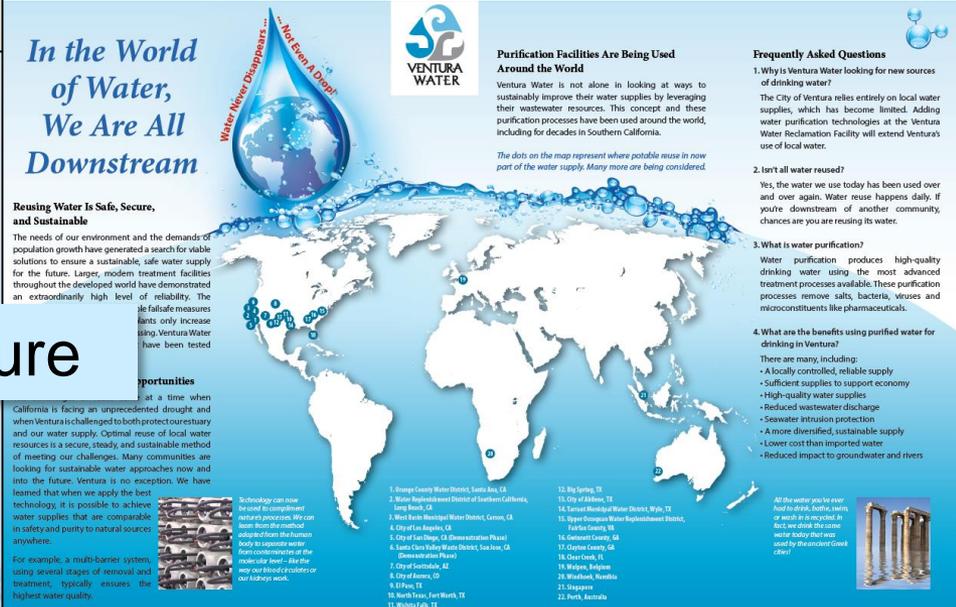


Webpage

Social Media



Banners

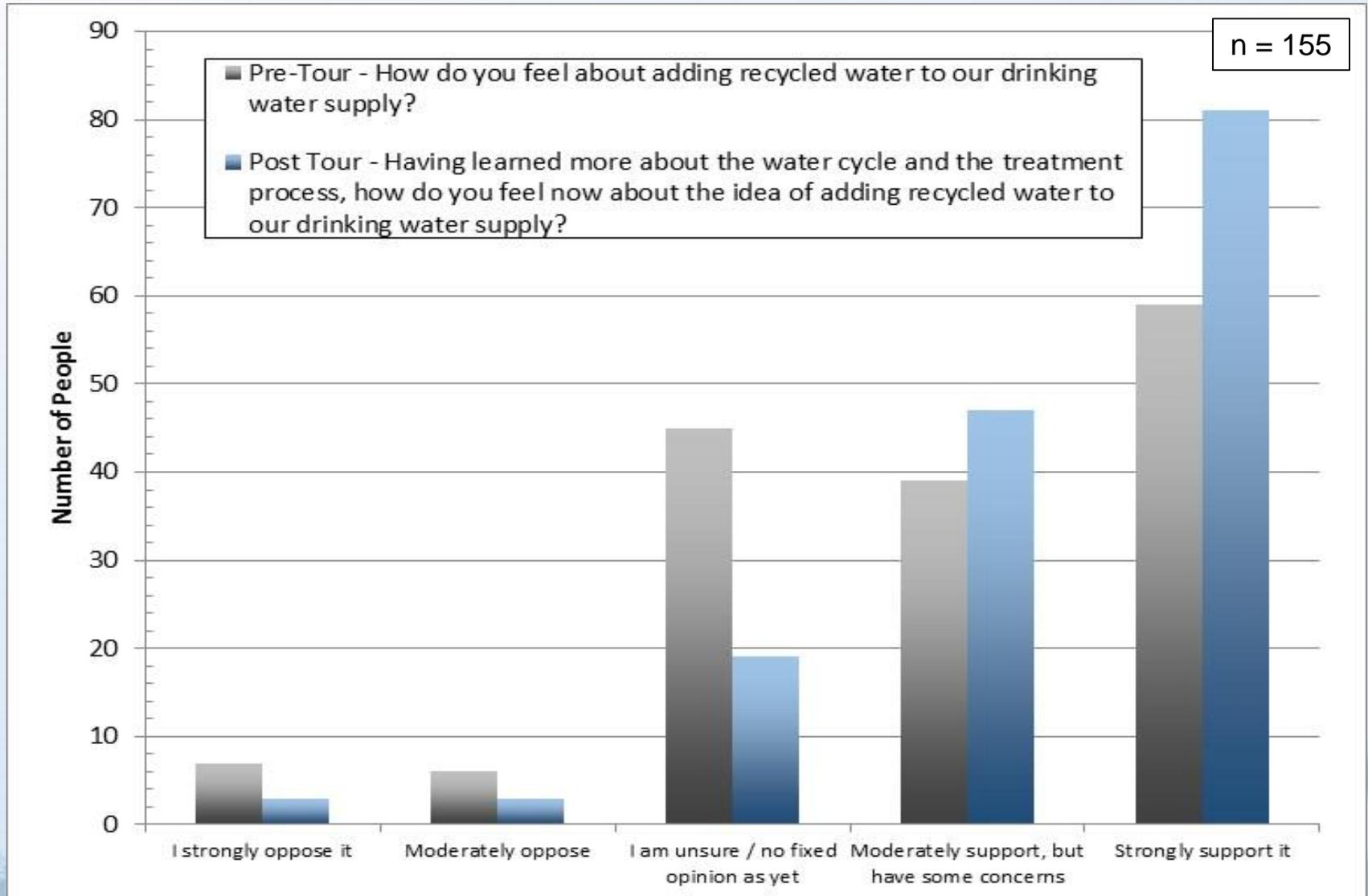


Brochure

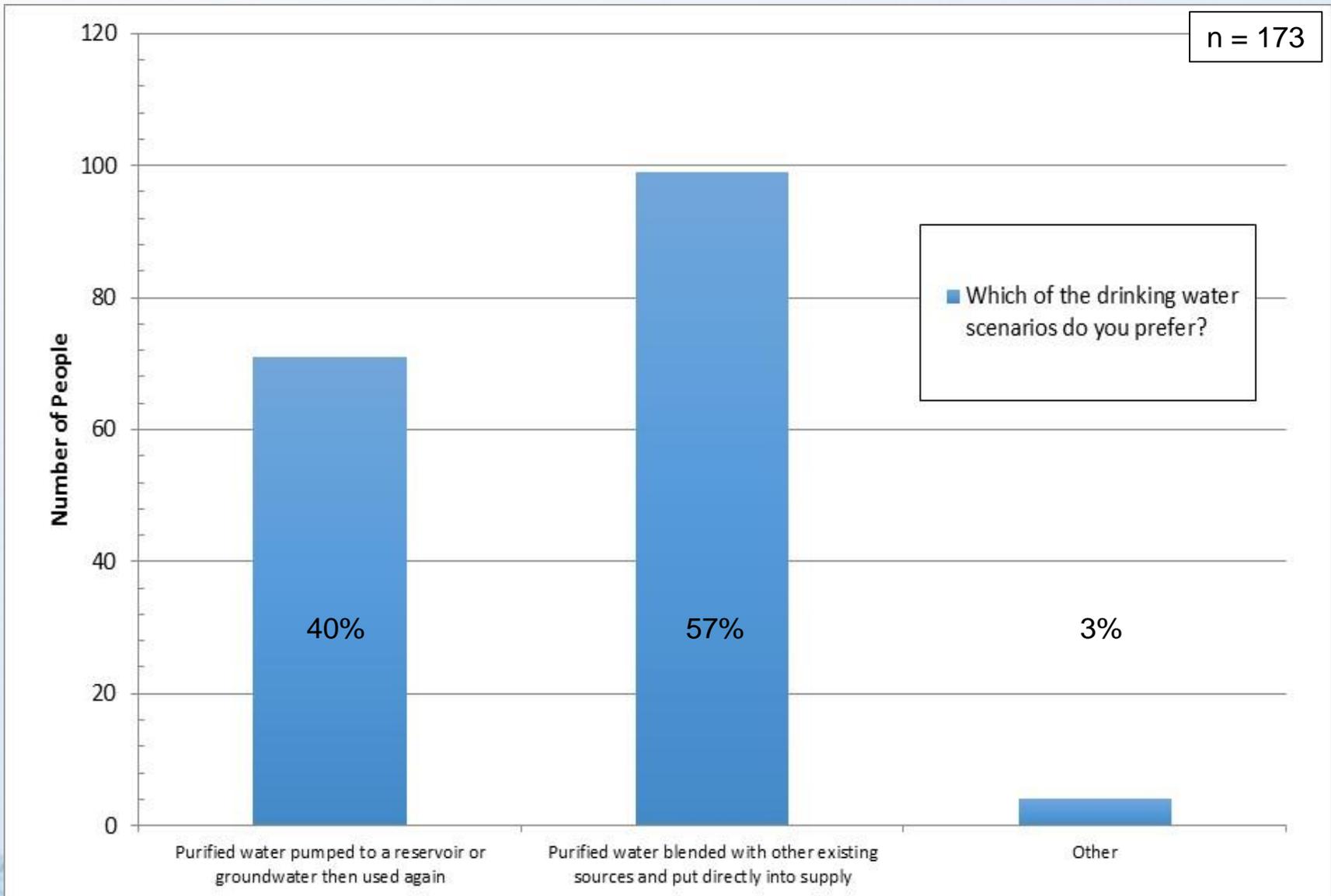
Ventura WaterPure - Grand Opening Media Event



Visitors to the Demonstration Facility Support Potable Water Reuse

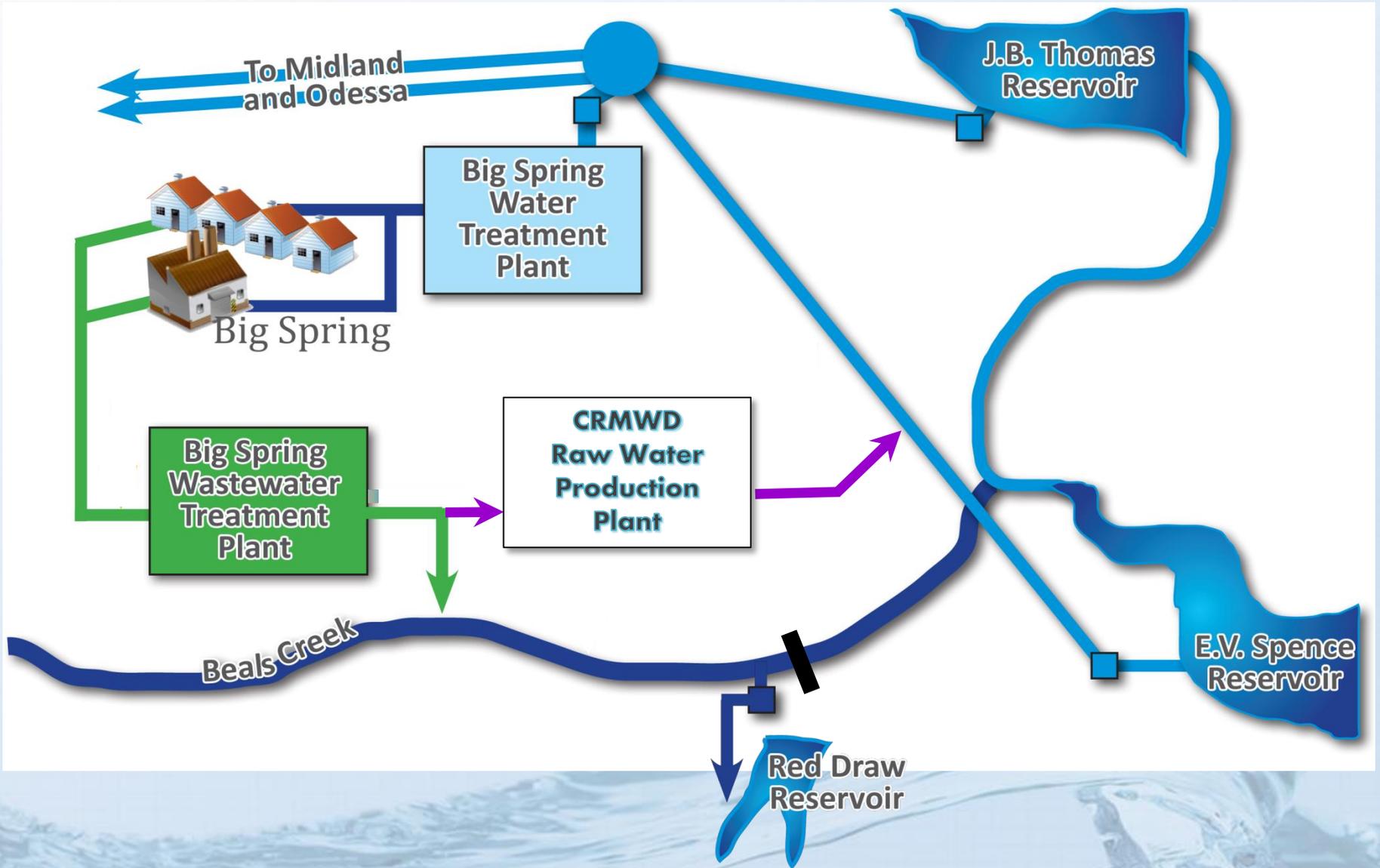


DPR is Preferred over IPR



Texas

DPR in Big Spring (TX)



Colorado River Municipal Water District Raw Water Production Facility



Microfiltration

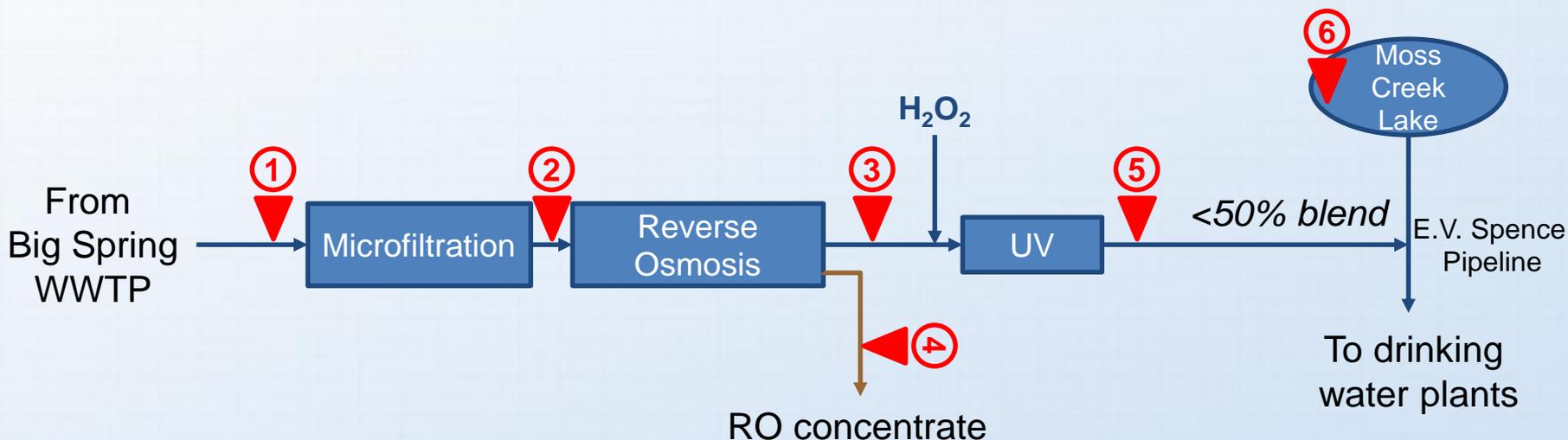


Reverse Osmosis



UV-AOP

Raw Water Production Facility in Big Spring Provides Supply Diversification



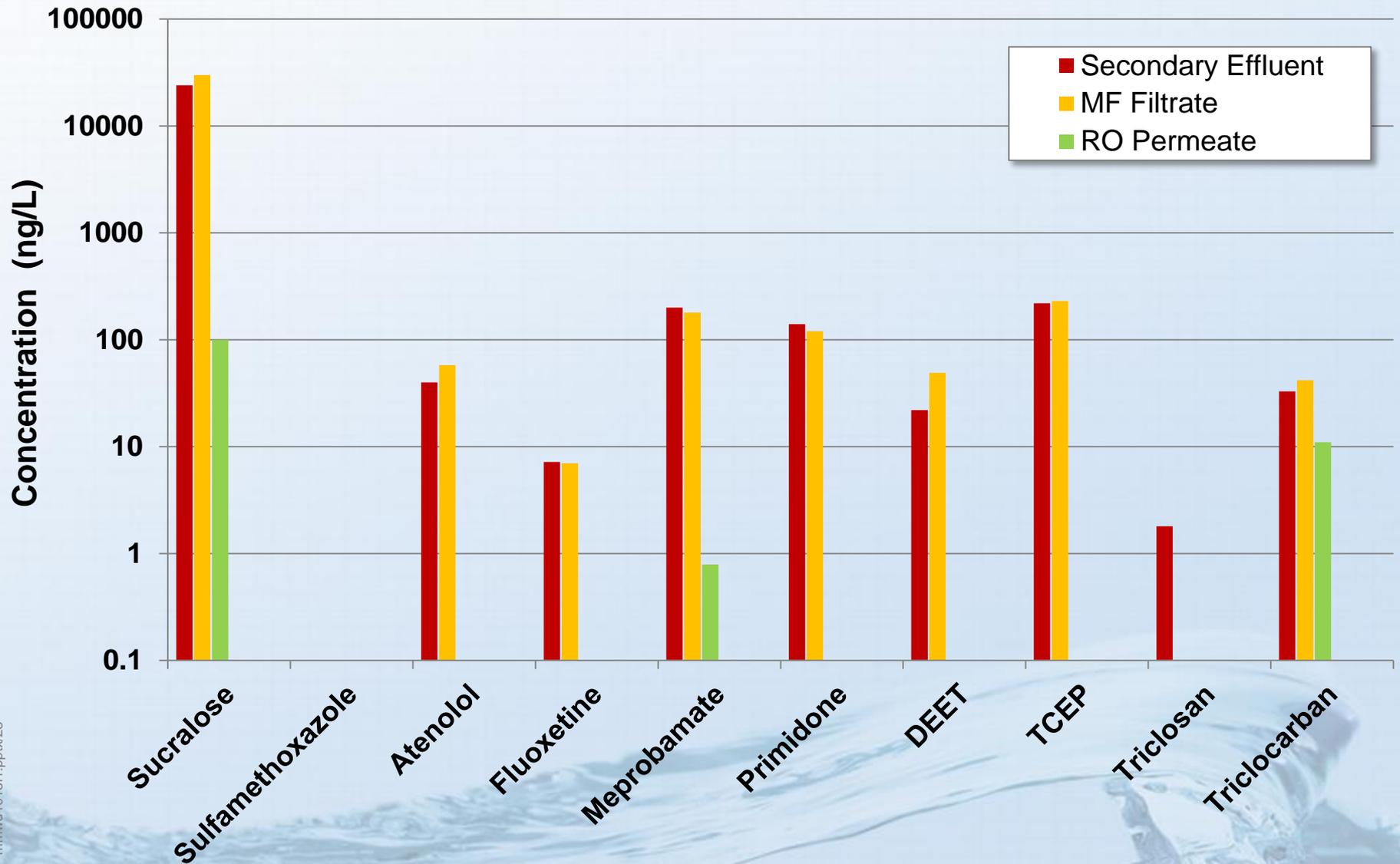
Study Sponsored by:



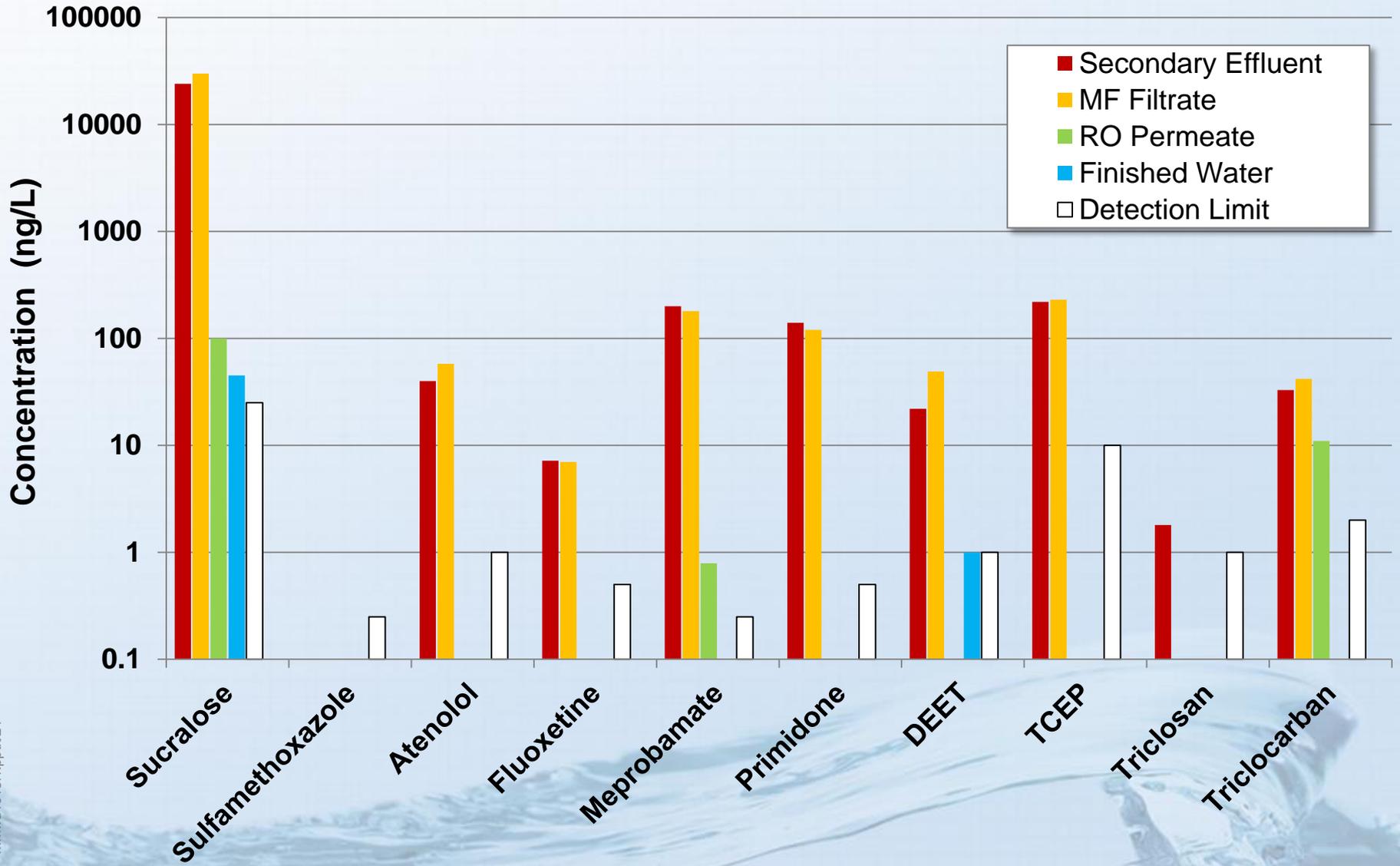
Research Partners:

- Carollo Engineers
- Trussell Technologies
- University of Texas
- Southern Nevada Water Authority
- Nalco Company
- Hazen & Sawyer

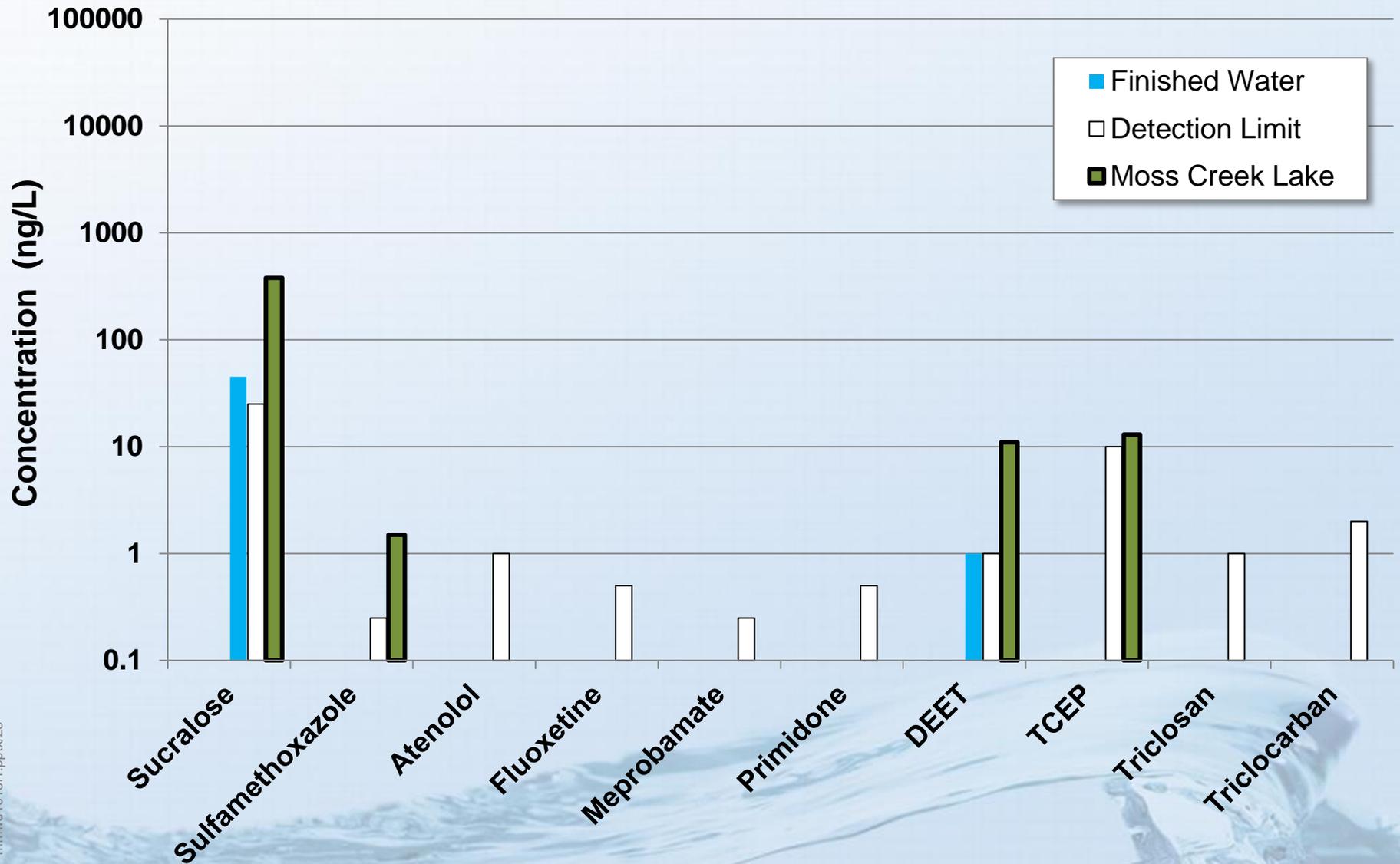
RO Achieves Robust Removal of Trace Organics (Pharmaceuticals etc.)



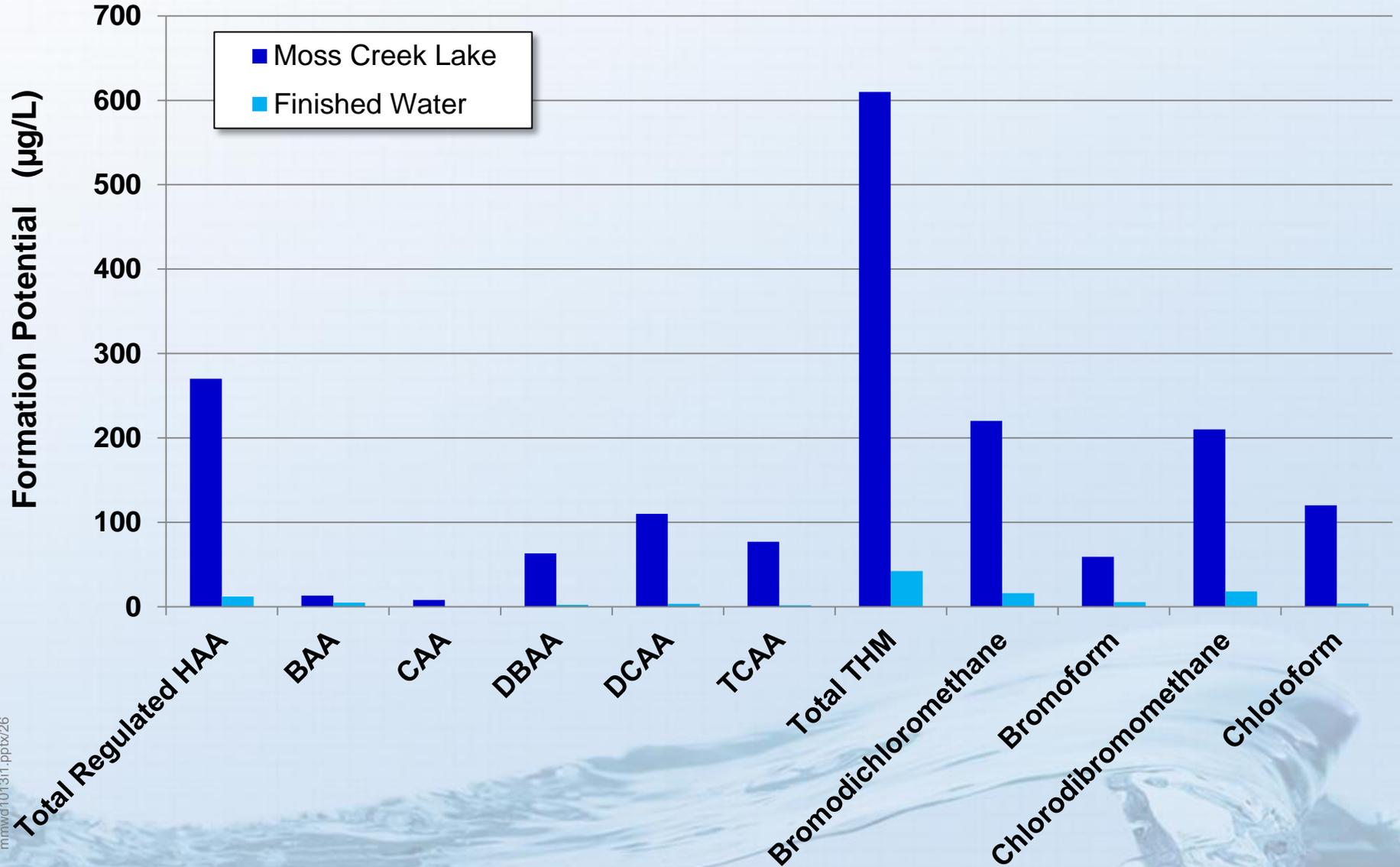
AOP Finishes the Job



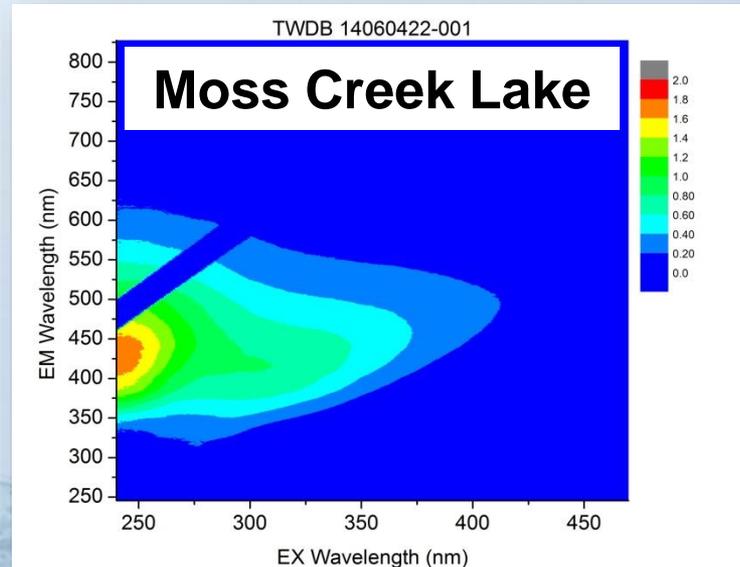
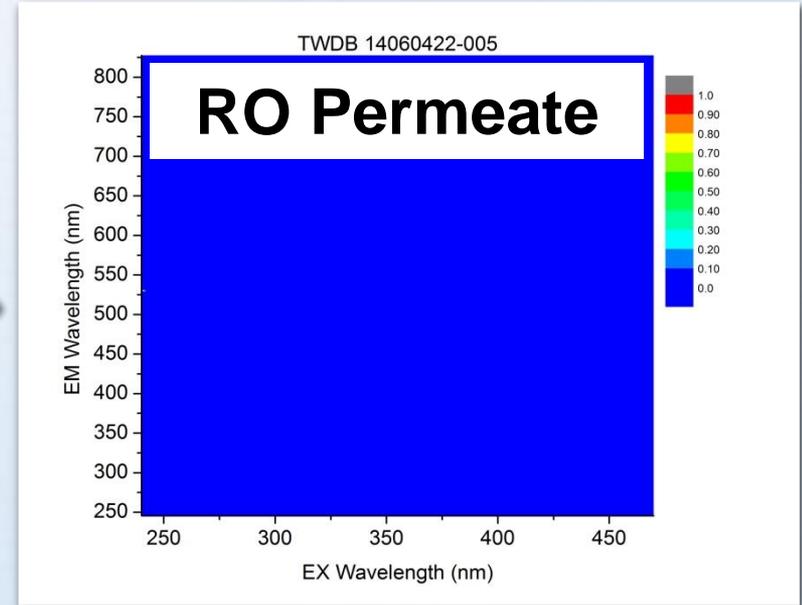
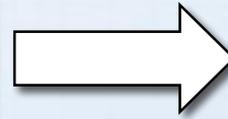
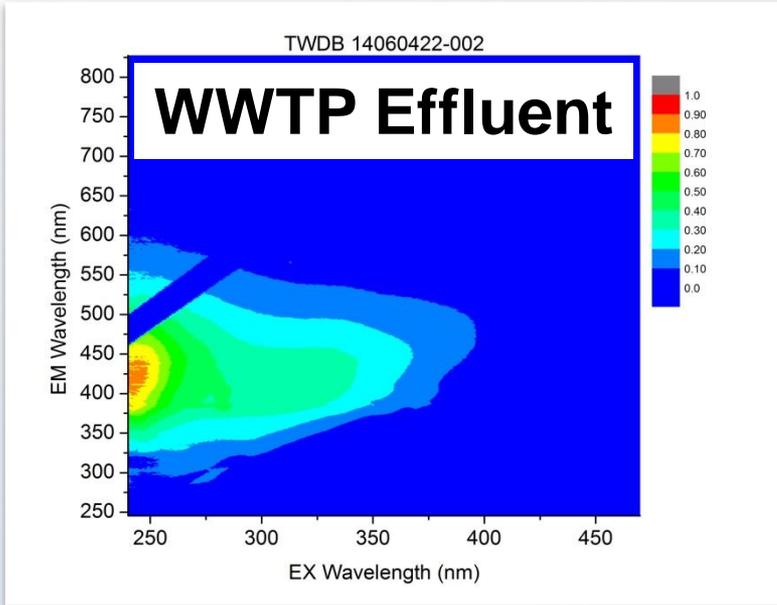
DPR Finished Water Improves Quality



Formation Potential Tests Illustrate the DBP Advantage of RWPF Water



Fluorescence Images Tell a Good Story



Clean Water Services Oregon

Clean Water Services Strives for Industry Leadership

- Phosphorus recovery
- Watershed permit
- Wetlands for temperature mitigation and nutrient removal
- **High purity water demonstration project**
 - Expand opportunities for water reuse
 - Demonstrate that water can be treated to any level regardless of its original source
 - Raise public awareness about water reuse
 - Showcase collaboration between the private sector and local/state government

Pilot Scale Treatment Train Using the State of the Art Treatment Technologies

Ultrafiltration



Reverse Osmosis



**UV/H₂O₂
Advanced Oxidation**



- Evoqua (Siemens) – Let us borrow UF and RO units
- Trojan – UV AOP

Demonstration Testing Verifies Treatment Performance

- Pathogen removal through UF, RO and UV
- CEC* removal through RO and AOP
- Finished water quality meets and exceeds drinking water standards



* CEC – compound of emerging concern

Pathogen Log Removal Performance

	UF	RO	AOP	Total	Proposed Standard
Virus	4.7	4.3	6	15	12
Protozoa	4.7	4.3	6	15	10
Bacteria	4.7	4.3	6	15	9

Exceeds proposed pathogen reduction standards

CEC* Removal Performance

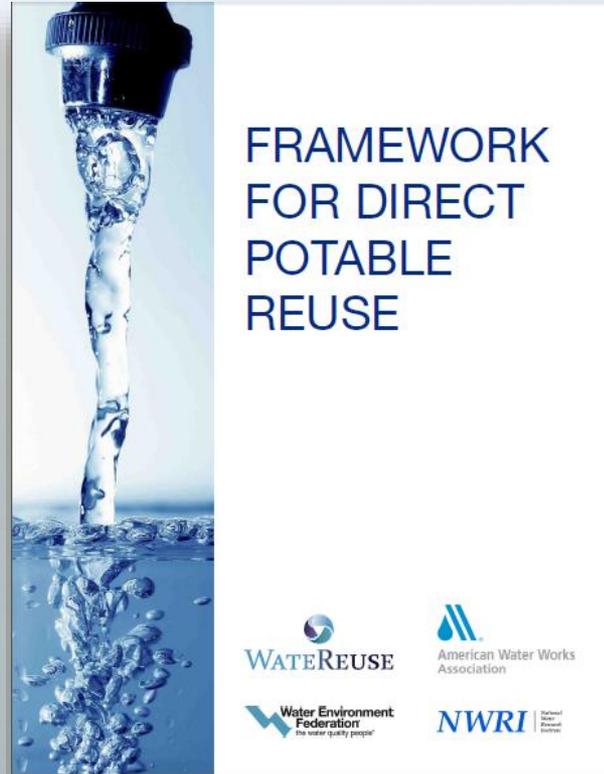
DBPs		Criterion	Result				
THMs		80 ug/L	ND				
HAA5	Pharmaceuticals		Criterion	Result			
NDMA	Cotine		1 ug/L	ND			
Bromate	Primidone	Chemicals Relevant to Public Health		Criterion	Result		
Chlorate	Meprobam			Criterion	Result		
	Atenolol	PFOA	0.4 ug/L	ND			
	Carbamaze	PFOS	0.2 ug/L	ND			
	Estrone	Perchlor	Steriodal Hormones		Criterion	Result	
		1,4-Diox	Ethinyl Estradiol			ND	
			17-β-Estrad	Other Chemicals		Criterion	Result
				Sucralose	150 mg/L	ND	
				TCEP	5 ug/L	ND	
				DEET	200 ug/L	ND	
				Triclosan	2,100 ug/L	ND	

+ Exceeds all drinking water standards

* CEC – compound of emerging concern

National DPR Framework

DIRECT POTABLE REUSE FRAMEWORK DOCUMENT



Free online:

www.watereuse.org

NATIONAL WATER RESEARCH INSTITUTE
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FRAMEWORK DOCUMENT INDEPENDENT ADVISORY PANEL

George Tchobanoglous, Panel Chair
Joseph “Joe” Cotruvo
James “Jim” Crook
Ellen McDonald
Adam Olivieri
Andrew “Andy” Salveson
R. Shane Trussell

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ORGANIZATION OF DPR FRAMEWORK DOCUMENT

- 1. Introduction**
- 2. What is Direct Potable Reuse?**
- 3. Key Components of a Successful/Sustainable DPR Program**
- 4. Public Health Protection**
- 5. Source Control Programs**
- 6. Wastewater Treatment**
- 7. Advanced Water Treatment**
- 8. Purified and Finished Water Management**
- 9. Monitoring and Instrumentation Requirements**
- 10. Residuals Management**
- 11. Facility Operation**
- 12. Public Outreach**
- 13. Future Developments**

Questions?

