OneWater Nevada
Our Sustainable Water Future

Nevada's First Advanced Purified Water Demonstration Study

Arizona WateReuse

July 27, 2021

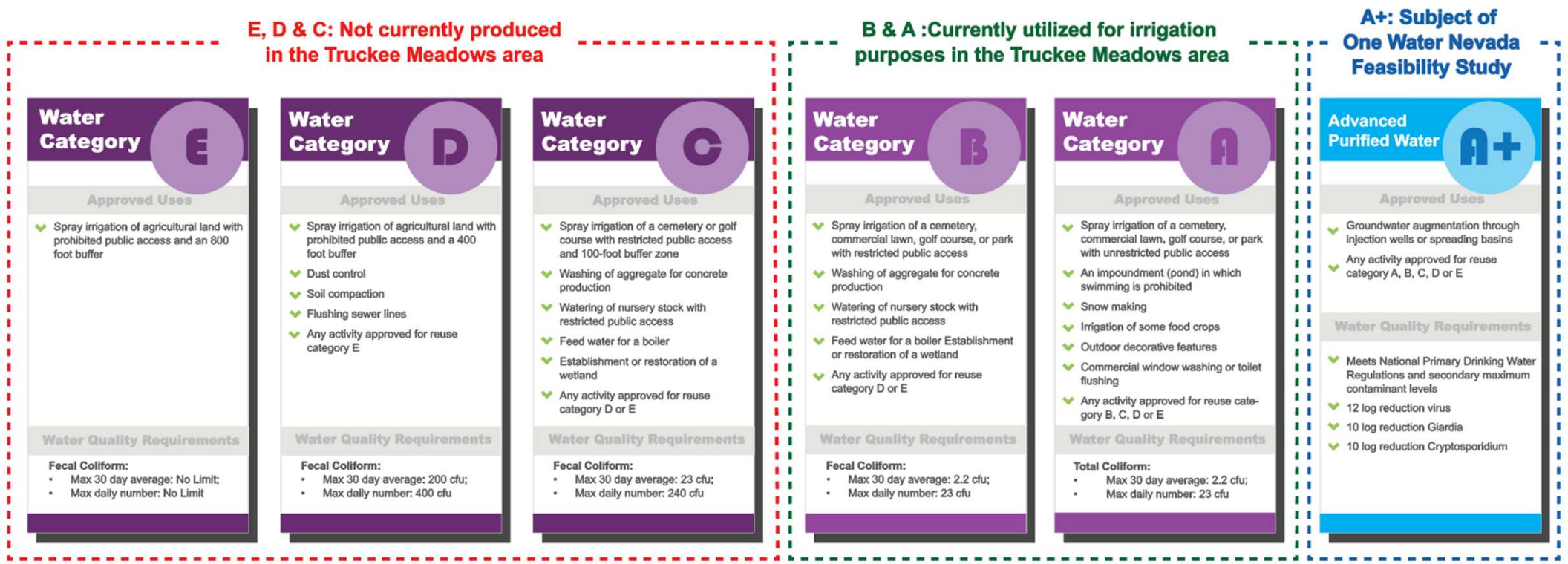
University of Nevada, Reno · City of Reno · Washoe County, Nevada 1861 · Truckee Meadows Water Authority · Quality. Delivered. · Western Regional Water Commission · Northern Nevada Water Planning Commission · Truckee Meadows Water Reclamation Facility · City of Sparks

Current Reclaimed Water Uses in the Truckee Meadows

- Water sourced from regional water reclamation facilities
- Decades of water recycling experience
- 10 % of total water supply
- Regulated by the State of Nevada Division of Environmental Protection

State of Nevada Reclaimed Water Regulations

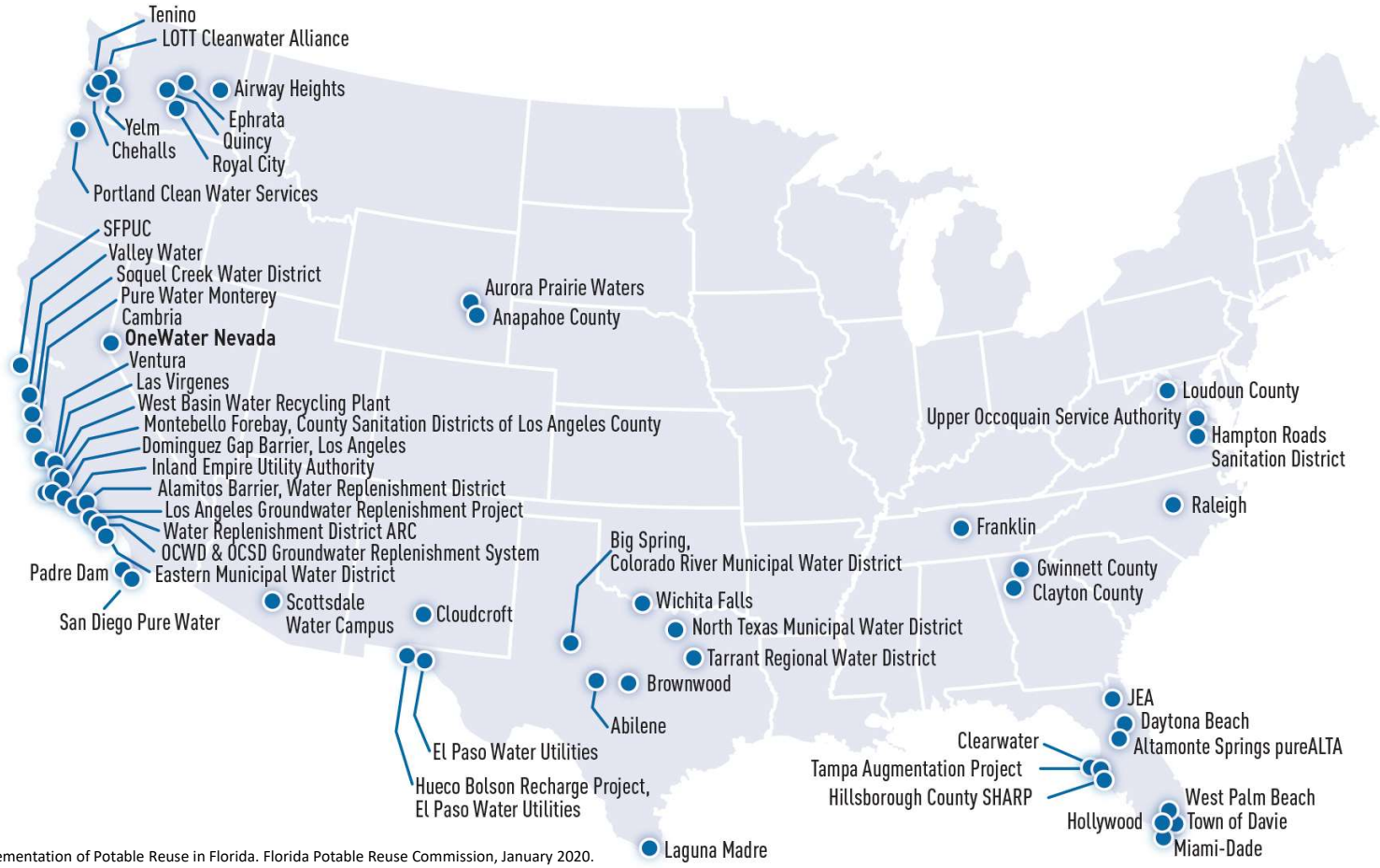
The A+ water category was established in 2016 by the Nevada Division of Environmental Protection. It requires treatment to drinking water standards and allows for direct injection into groundwater aquifers.



Water Quality Objectives – Category A+ Requirements

- Federal Primary Drinking Water Regulations
- Nevada Secondary MCLs
- 12/10/10 LRV Enteric Virus, Giardia and Cryptosporidium
  - 3 pathogen barriers
- Remove unregulated constituents to below health guidance levels
- Requires environmental buffer
- No regulated TOC limit – internal goal of 2mg/L
- No blending requirement

National Advanced Purified Water Programs and Demonstrations



Source: Framework for the Implementation of Potable Reuse in Florida. Florida Potable Reuse Commission, January 2020.

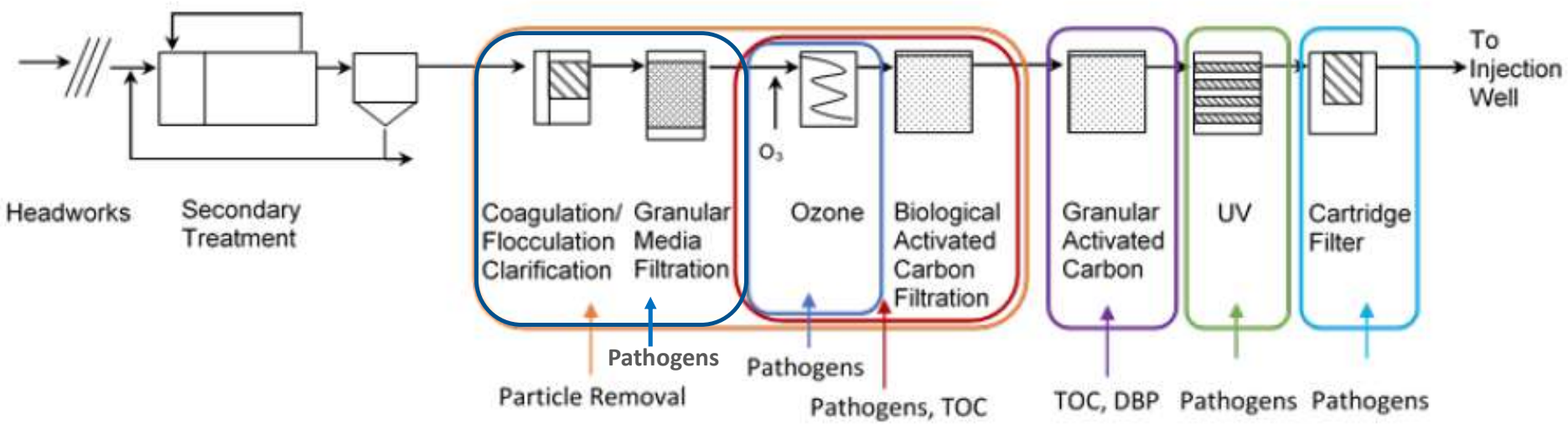
OneWater Nevada: Reno-Stead Water Reclamation Facility

University of Nevada, Reno · RENO · Washoe County, Nevada 1861 · Truckee Meadows Water Authority — Quality. Delivered. · Western Regional Water Commission · Northern Nevada Water Planning Commission · Truckee Meadows Water Reclamation Facility · City of Sparks

RSWRF Demonstration Study

- **Determine if advanced purified water can provide long-term benefits for our region's water future.**
- 3 trailers housed advanced water treatment technologies
  - Small scale – 10-15 gpm
- Reno Stead WRF October 2019-November 2020
  - Injected late September to early November 2020
    - Regulated under temporary discharge and UIC permits
- TMWA and City of Reno maintained and operated the units
- UNR developed sampling program
- TMWA hydrogeologists managed temporary injection

Processes & Contaminants of Interest



Trailer 1: Conventional Filtration

- Coagulation, Flocculation, Clarification, Granular Media Filtration
- **Goals:** pathogen removal, turbidity and TOC reduction
- LT2ESWTR met 0.15 NTU 95% of time
- New to wastewater applications
  - Non membrane approach

WesTech®

Trailer 2: Ozone Biologically Active Carbon

- Ozone oxidizes and degrades organic compounds (CECs)
- Filtered through a biologically active carbon filter
  - Organic compounds are adsorbed and concentrations are significantly reduced
- Must consider bromate and disinfection by-product formation
- UNR performed MS2 spiking study across ozonation

xylem

Trailer 3: GAC and UV Disinfection

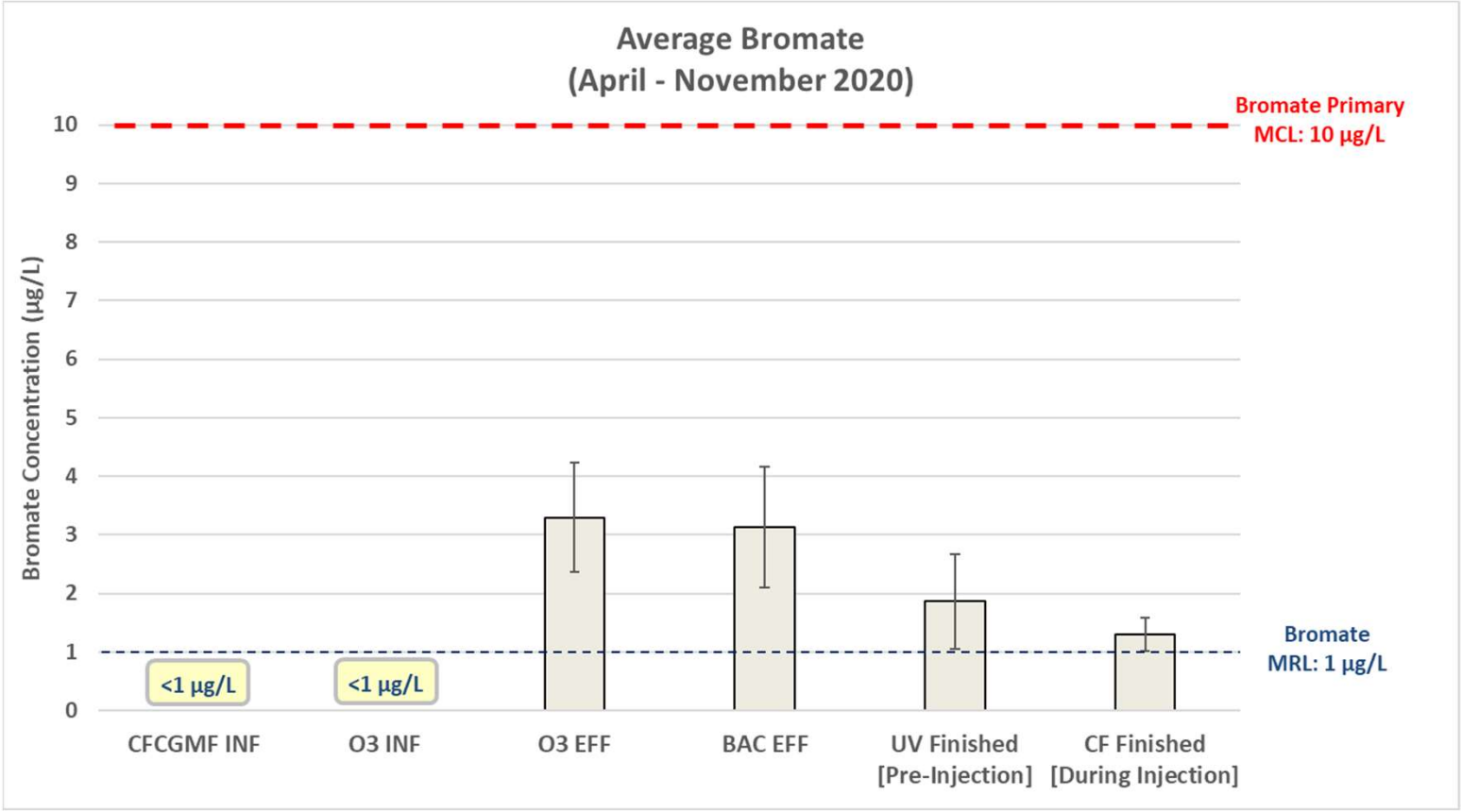
- GAC for additional polishing and TOC reduction <2mg/L (Jacobi Carbons)
- Ultraviolet Disinfection for pathogen removal and virus inactivation
- Trailer owned by OneWater Nevada
- Can be a research platform for universities and other cities

Groundwater Injection

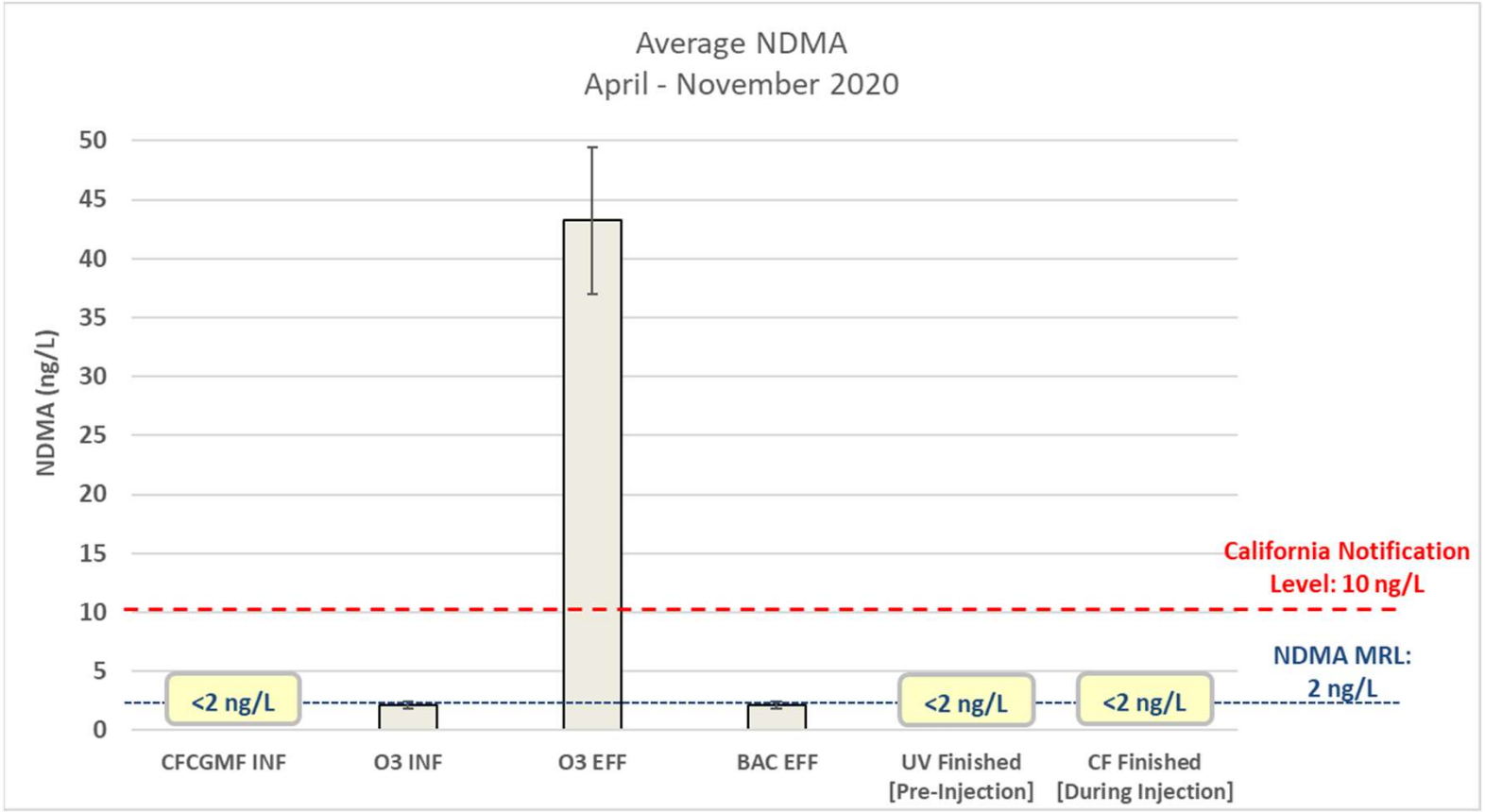
- 75-day injection of potable water with SF_6 gas tracer
- 45-day injection of 220,000 gallons A+ water with chloride tracer
- Extraction well 80 ft away
- Extensive water quality sampling
- Groundwater flow and transport modeling
- Geochemical modeling

Water Quality Results

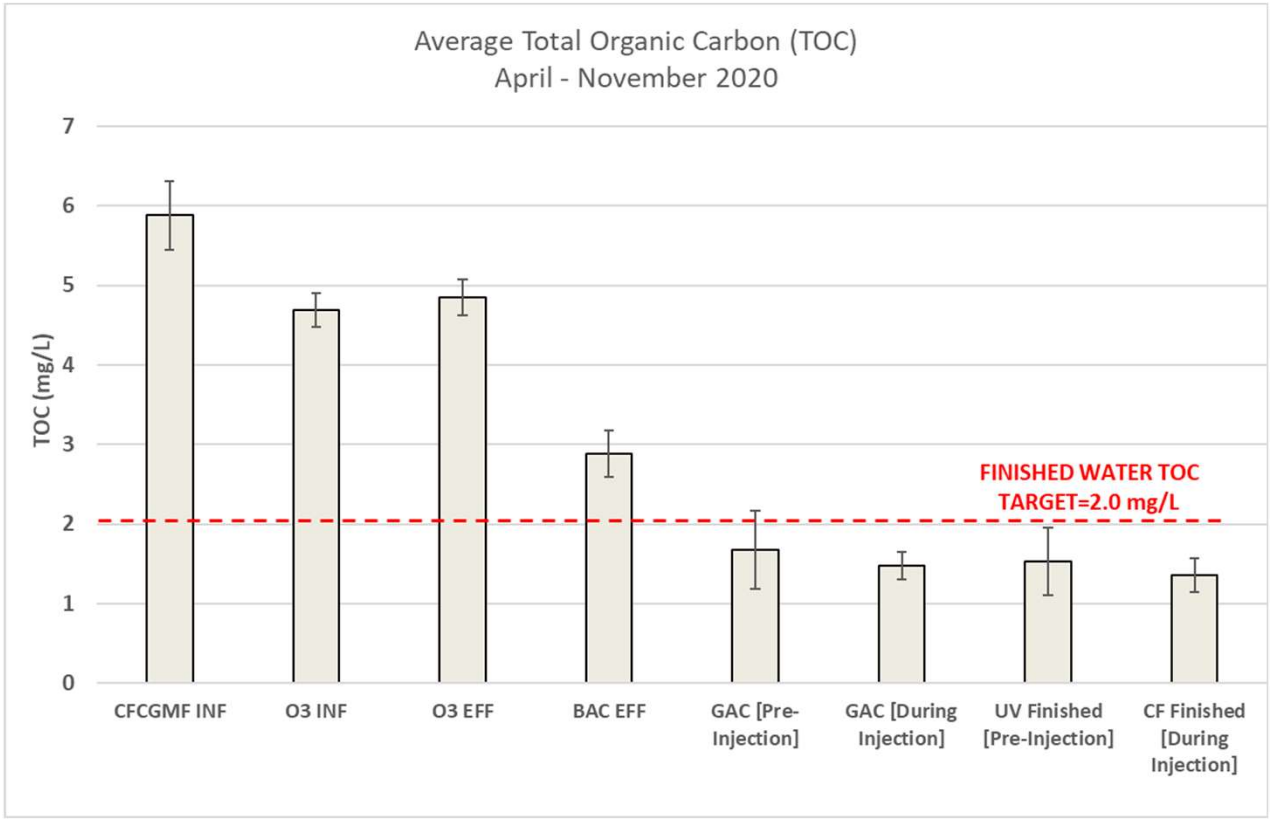
Bromate


Average Bromate
(April - November 2020)
Bromate Primary
MCL: 10 µg/L
Bromate Concentration (µg/L)
10
9
8
7
6
5
4
3
2
1
0
<1 µg/L
<1 µg/L
Bromate
MRL: 1 µg/L
CFCGMF INF
O3 INF
O3 EFF
BAC EFF
UV Finished
[Pre-Injection]
CF Finished
[During Injection]

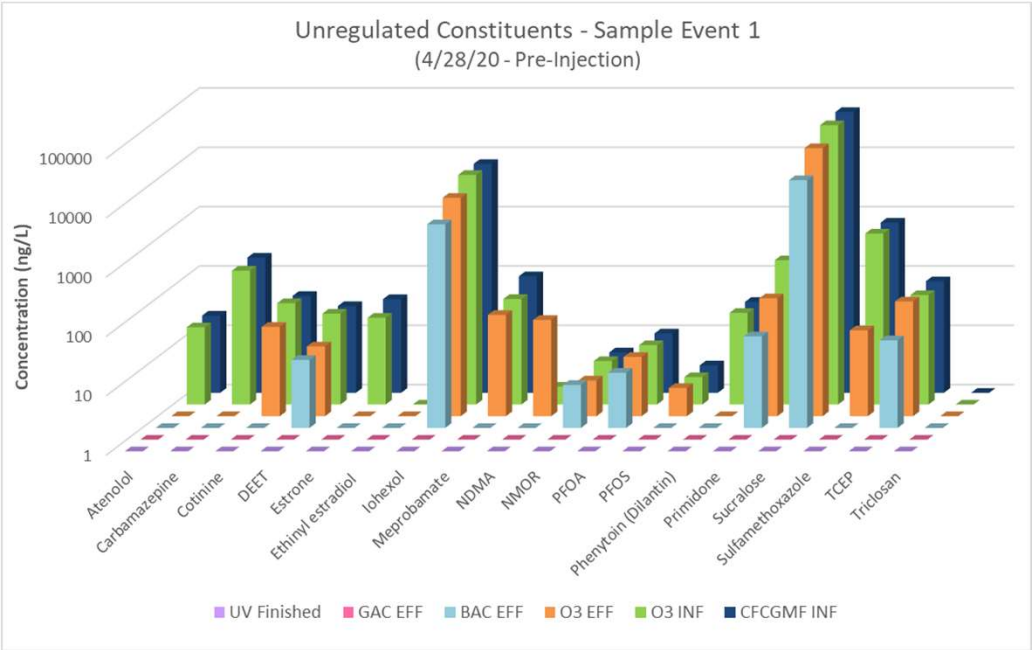
NDMA

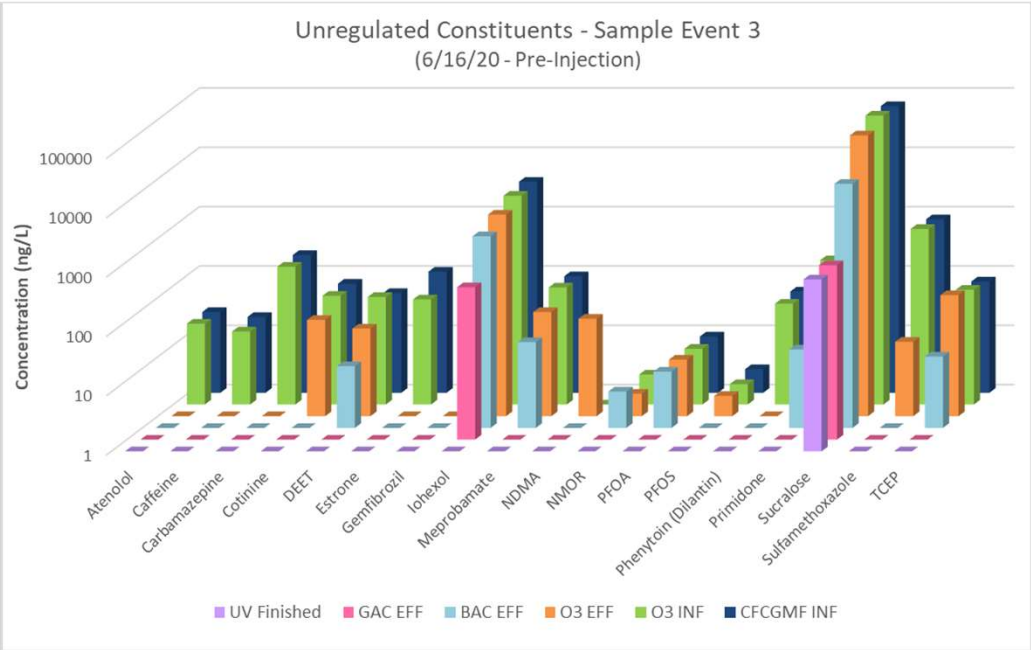

Average NDMA
April - November 2020
NDMA (ng/L)
50
45
40
35
30
25
20
15
10
5
0
<2 ng/L
<2 ng/L
<2 ng/L
California Notification Level: 10 ng/L
NDMA MRL: 2 ng/L
CFCGMF INF
O3 INF
O3 EFF
BAC EFF
UV Finished [Pre-Injection]
CF Finished [During Injection]

Total Organic Carbon



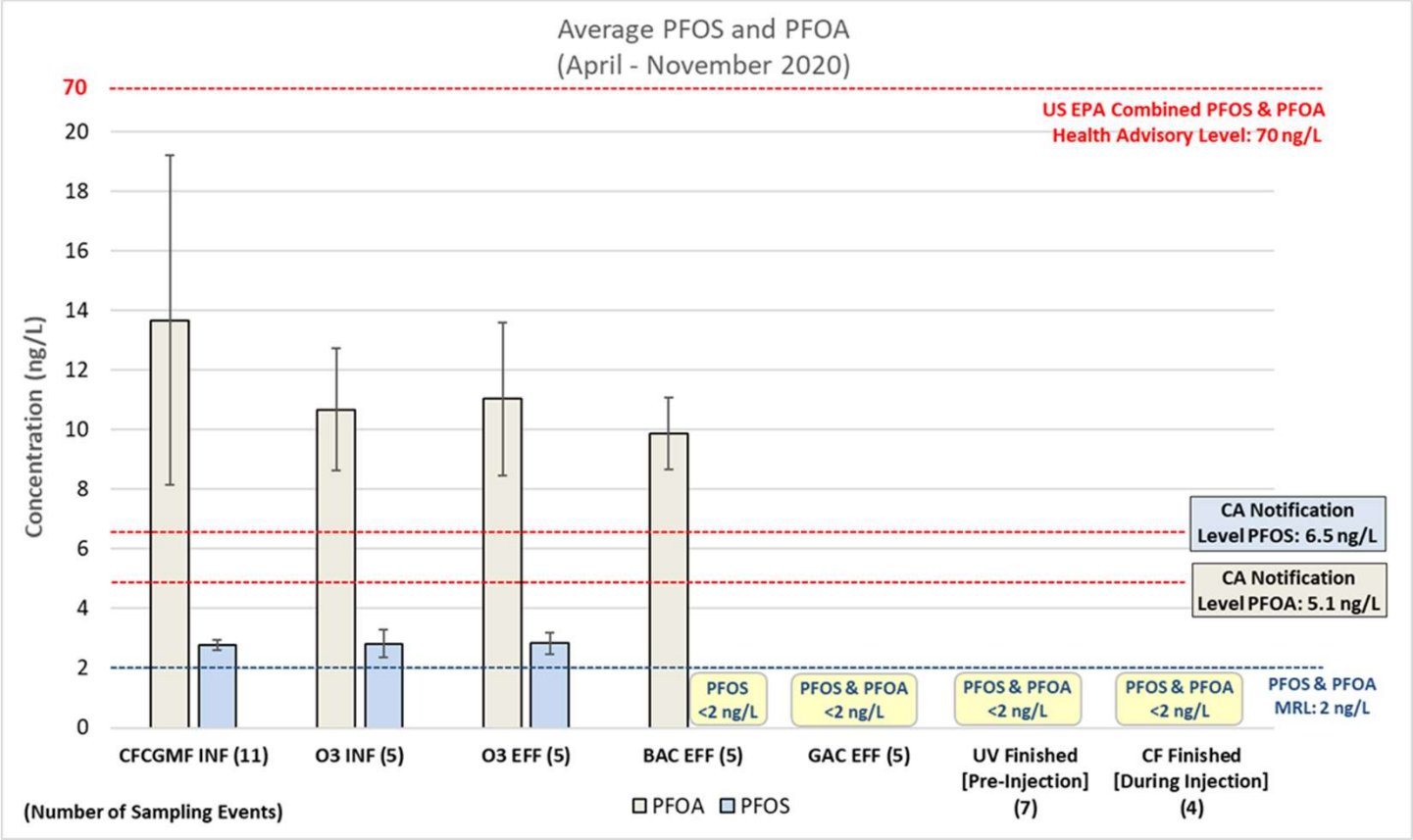
CECs: Pre-Injection



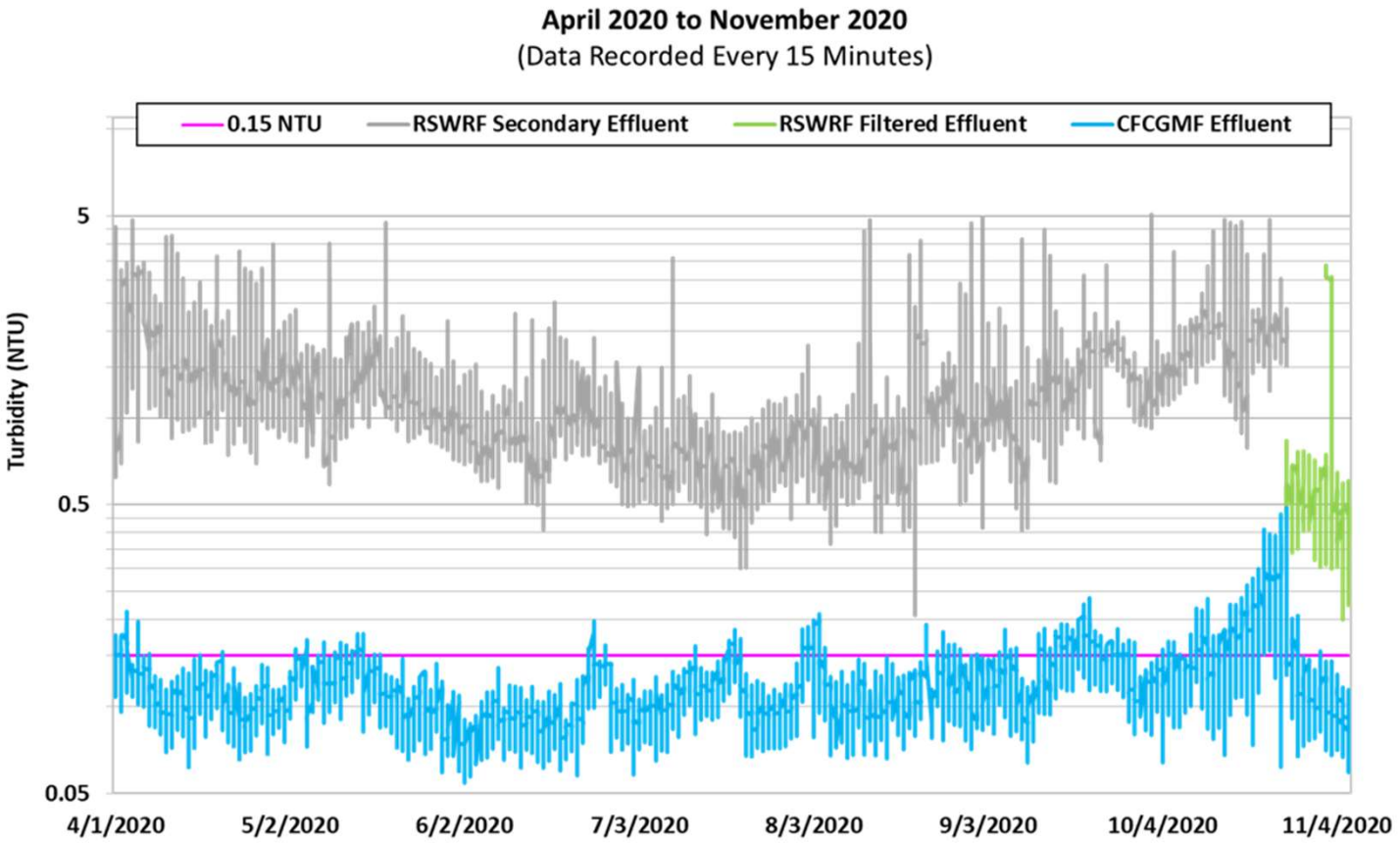


Non-detect values displayed as <1 ng/L in all plots

PFOS and PFOA



CFCGMF Turbidity



Summary of Results

- All water quality regulations and objectives were met
  - National Primary Drinking Water contaminants were below MCLs
  - NV Secondary contaminants were below SMCLs
  - Pathogens were non-detect or zero
  - Unregulated CECs were non-detect or below guidance levels
- Successfully injected 220,000 gallons of A+ water
- Conventional water treatment approaches show promise
- Carbon-based APW treatment train has been selected for future planning in the area

Social Aspects and Legitimacy

Independent Expert Panel

Steinle-Darling Robinson Salveson Campbell Mosher Karimova Crook Hultquist Millan

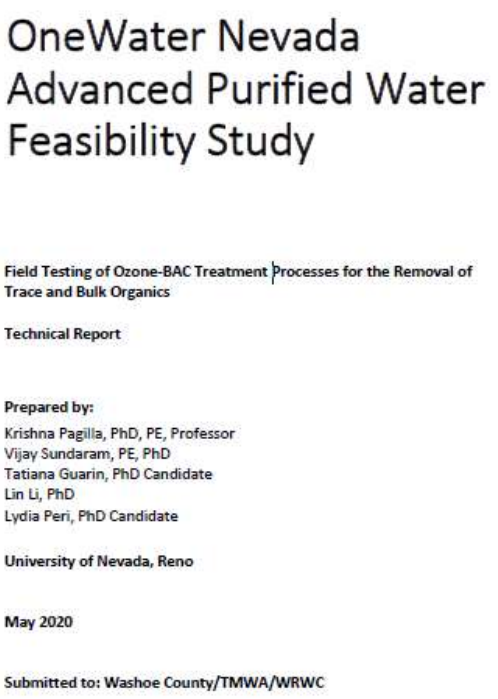
Independent Expert Panel

- Panel Process
  - Use of independent experts in the field; collaborative process
  - Written findings and recommendations
- Reviewed Nevada regulations (NAC 445A) in 2016
- Areas reviewed by Panel
  - Public health protection
  - Treatment process
  - Approach for meeting pathogen reduction requirements
  - List of unregulated constituent monitoring
  - Reviewed pilot test plan
  - Reviewed outreach and communication approaches
  - Using best available information for emerging subject matter

University of Nevada's Role

- Treatment technology evaluations
  - Research different types of advanced purified water technologies
- Basis of design
  - How the technology meets operational objectives and water quality goals
- Water quality program development
  - Create plan of what to sample, how often, and what lab will analyze based on A+ requirements plus additional compounds
- Quality assurance and quality control
  - How to ensure the water quality program meets expectations and results are accurate
- Sampling
  - Student assistance with sampling, lab analysis and technology validations

University of Nevada's Role



OneWater Nevada
Advanced Purified Water
Feasibility Study

Field Testing of Ozone-BAC Treatment Processes for the Removal of Trace and Bulk Organics

Technical Report

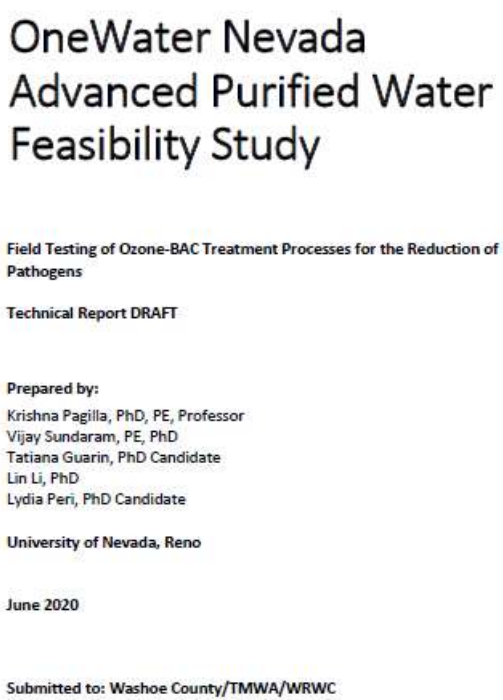
Prepared by:

Krishna Pagilla, PhD, PE, Professor
Vijay Sundaram, PE, PhD
Tatiana Guarin, PhD Candidate
Lin Li, PhD
Lydia Peri, PhD Candidate

University of Nevada, Reno

May 2020

Submitted to: Washoe County/TMWA/WRWC



OneWater Nevada
Advanced Purified Water
Feasibility Study

Field Testing of Ozone-BAC Treatment Processes for the Reduction of Pathogens

Technical Report DRAFT

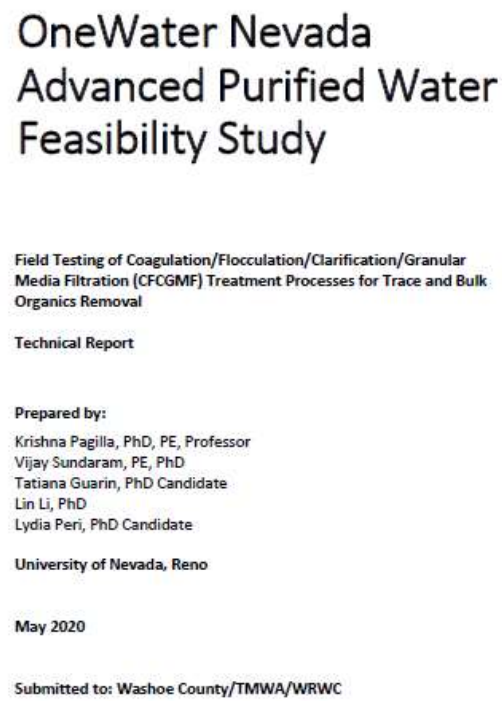
Prepared by:

Krishna Pagilla, PhD, PE, Professor
Vijay Sundaram, PE, PhD
Tatiana Guarin, PhD Candidate
Lin Li, PhD
Lydia Peri, PhD Candidate

University of Nevada, Reno

June 2020

Submitted to: Washoe County/TMWA/WRWC



OneWater Nevada
Advanced Purified Water
Feasibility Study

Field Testing of Coagulation/Flocculation/Clarification/Granular Media Filtration (CFCGMF) Treatment Processes for Trace and Bulk Organics Removal

Technical Report

Prepared by:

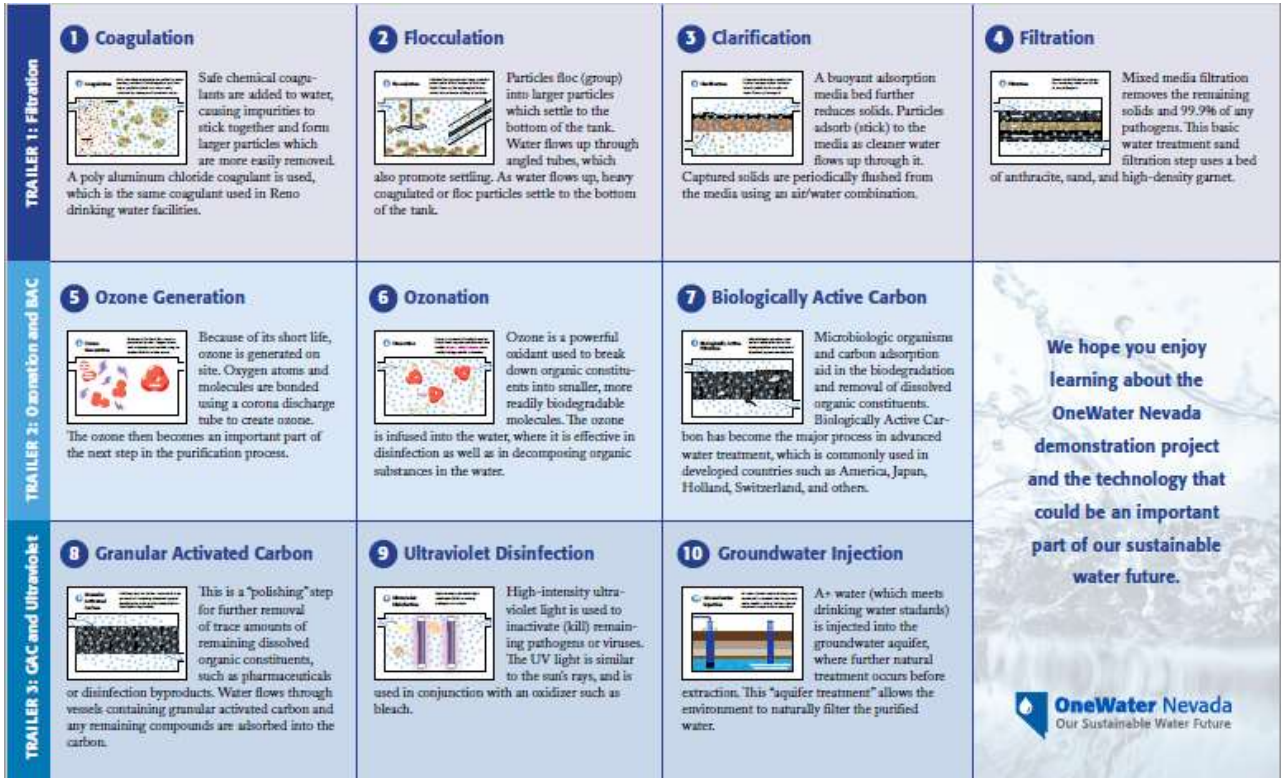
Krishna Pagilla, PhD, PE, Professor
Vijay Sundaram, PE, PhD
Tatiana Guarin, PhD Candidate
Lin Li, PhD
Lydia Peri, PhD Candidate

University of Nevada, Reno

May 2020

Submitted to: Washoe County/TMWA/WRWC

Informational Handouts



TRAILER 1: Filtration

1 Coagulation

Safe chemical coagulants are added to water, causing impurities to stick together and form larger particles which are more easily removed. A poly aluminum chloride coagulant is used, which is the same coagulant used in Reno drinking water facilities.

2 Flocculation

Particles floc (group) into larger particles which settle to the bottom of the tank. Water flows up through angled tubes, which also promote settling. As water flows up, heavy coagulated or floc particles settle to the bottom of the tank.

3 Clarification

A buoyant adsorption media bed further reduces solids. Particles adsorb (stick) to the media as cleaner water flows up through it. Captured solids are periodically flushed from the media using an air/water combination.

4 Filtration

Mixed media filtration removes the remaining solids and 99.9% of any pathogens. This basic water treatment sand filtration step uses a bed of anthracite, sand, and high-density garnet.

TRAILER 2: Ozonation and BAC

5 Ozone Generation

Because of its short life, ozone is generated on site. Oxygen atoms and molecules are bonded using a corona discharge tube to create ozone. The ozone then becomes an important part of the next step in the purification process.

6 Ozonation

Ozone is a powerful oxidant used to break down organic constituents into smaller, more readily biodegradable molecules. The ozone is infused into the water, where it is effective in disinfection as well as in decomposing organic substances in the water.

7 Biologically Active Carbon

Microbiologic organisms and carbon adsorption aid in the biodegradation and removal of dissolved organic constituents. Biologically Active Carbon has become the major process in advanced water treatment, which is commonly used in developed countries such as America, Japan, Holland, Switzerland, and others.

We hope you enjoy learning about the OneWater Nevada demonstration project and the technology that could be an important part of our sustainable water future.

OneWater Nevada
Our Sustainable Water Future

TRAILER 3: GAC and Ultraviolet

8 Granular Activated Carbon

This is a "polishing" step for further removal of trace amounts of remaining dissolved organic constituents, such as pharmaceuticals or disinfection byproducts. Water flows through vessels containing granular activated carbon and any remaining compounds are adsorbed into the carbon.

9 Ultraviolet Disinfection

High-intensity ultraviolet light is used to inactivate (kill) remaining pathogens or viruses. The UV light is similar to the sun's rays, and is used in conjunction with an oxidizer such as bleach.

10 Groundwater Injection

A+ water (which meets drinking water stadards) is injected into the groundwater aquifer, where further natural treatment occurs before extraction. This "aquifer treatment" allows the environment to naturally filter the purified water.

Lessons Learned

- University Utility partnership is invaluable
- IEP being available as advisors helped the project team
- Keep elected officials informed and engaged
- Connecting wastewater and drinking water operations creates success for the future
- Considerable operator and maintenance staff requirements
- Involve regulators in conversations early on

Next Steps

- Completion of Final Report (April 2021)
- Establish City of Reno / TMWA long-term objectives and collaboration agreement going forward
- Conduct full scale 2 MGD demonstration scale A+ facility planning / basis of design
- Validate hydrogeologic and geochemical assessments of potential 2 MGD recharge site
- Source water monitoring and assessment

OneWater Nevada
Our Sustainable Water Future

Contact Information

Lydia (Peri) Teel, P.E.
Emerging Resources Program Administrator
Truckee Meadows Water Authority
lperi@tmwa.com

Video: www.onewaternevada.com/links/

University of Nevada, Reno
City of Reno
Washoe County, Nevada 1861
Truckee Meadows Water Authority
Quality. Delivered.
Western Regional Water Commission
Northern Nevada Water Planning Commission
Truckee Meadows Water Reclamation Facility
City of Sparks