Appendix H: Selected Water Reuse Case Studies

NATIONAL WATER REUSE

ACTION PLAN

DRAFT

Appendix H: Compilation of Water Reuse Case Studies

Several compendia of case studies have been published in recent years, including the 2017 Potable ReuseCompendium and 2012GuidelinesforWaterReuse. Appendix H of the draft Action Plan is not a comprehensive compilation, but includes a select number of water reuse case study summaries that were provided in response to outreach during draft Action Plan development and from the public docket. Along with the abbreviated summaries located in the main body of the draft Action Plan, these examples illustrate the variety and complexity of water reuse projects happening around the United States.

This Appendix demonstrates how information provided from interested stakeholders was integrated in the draft Action Plan. It highlights specific water reuse applications, intended to spark interest and ideas, forming the foundation for implementation of future water reuse projects. The table below identifies the case studies presented in this Appendix and their source. The summaries below are as provided by the responsible organization and unedited for inclusion in this report. They are presented in no particular order.

Disclaimer

The case studies included within this Appendix are included for illustrative purposes only and are not intended to be exhaustive. Each case study is unique and site-specific, and technology may not be as effective as demonstrated. Inclusion in this Appendix does not imply that the draft Action Plan endorses, approves, or supports these actions in this or any other location.

Title	Source
1. Pure Water Monterey	Monterey One Water
2. City of Roseville	City of Roseville
3. City of Altamonte Springs, FL	EPA Region 4
4. Emory University	EPA Region 4
5. Indiantown Cogeneration Facility	EPA Region 4
6. Water Conserv II	EPA Region 4
7. Wichita Falls, Texas	Docket EPA-HQ-OW-2019-0174-0010
8. El Paso, Texas	Docket EPA-HQ-OW-2019-0174-0010
9. San Diego Pure Water	Docket EPA-HQ-OW-2019-0174-0010
10. Silicon Valley Advanced Water Purification Center	Docket EPA-HQ-OW-2019-0174-0010
11. Orange County Water District Groundwater Replenishment	Docket EPA-HQ-OW-2019-0174-0010
12. Sanitation Districts of Los Angeles County Recycled Water Information	Docket EPA-HQ-OW-2019-0174-0033
13. Sanitation Districts of Los Angeles County Stormwater Services Program	Docket EPA-HQ-OW-2019-0174-0033
14. California's Reuse of Produced Water for Human Consumption Crops	EPA Region 8
15. Denver Water	Denver Water
16. Water Reuse for Golf Course and Green Areas Irrigation at Palmas del Mar Resort and Residential Development, Puerto Rico	EPA Region 2

Pure Water Monterey

A Groundwater Replenishment Project

PURE WATER MONTEREY

Safe • Local • Sustainable

The Monterey Peninsula is situated along California's picturesque Central Coast. With the longest coastline of any California county, the area's mild climate attracts more than 9 million visitors annually and is home to diverse agriculture fields that generate $4.4 billion for the county's economy.

As a region isolated from state or federal water projects, the area must rely solely on its limited, local water resources. For Monterey Peninsula residents and businesses, water has historically come from two sources: 1) a local river (Carmel River) and 2) the ground (Seaside Groundwater Basin). Due to state and court-ordered reductions, these supplies are about to become very limited. To help address this challenge, Monterey One Water and its partners have come together to create a new, drought-resistant, and independent water supply: Pure Water Monterey (PWM).

Using a proven, advanced, multi-stage treatment process, Pure Water Monterey will turn used water into a safe, reliable, and sustainable water supply that complies with or exceeds strict state and federal drinking water standards. The purified water will then be used for groundwater replenishment.

3,500 ACRE FEET / YEAR
of Advanced Purified Recycled Water
produced for injection into the Seaside Groundwater Basin

~22% of the Monterey Peninsula's
water supply will be provided by Pure Water Monterey

1,000 ACRE FEET
potable water drought reserve to increase availability of recycled water for ag use during dry years

New Source Waters
will help increase tertiary treated recycled water for agricultural irrigation up to
4,400 ACRE FEET / YEAR

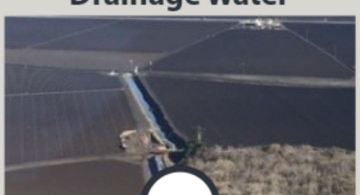
WHERE DOES THE USED WATER COME FROM?

For decades, Monterey One Water has helped diversify the local water supply through recycled water production for agriculture – helping irrigate 12,000 acres of freshly-edible food crops and prevent seawater intrusion. To address both the non-potable and potable water demands, PWM has identified additional used water sources to bring into its existing wastewater treatment system, including:

Secondary Treated Wastewater

67%

Agriculture Drainage Water



16%

Agriculture Wash Water

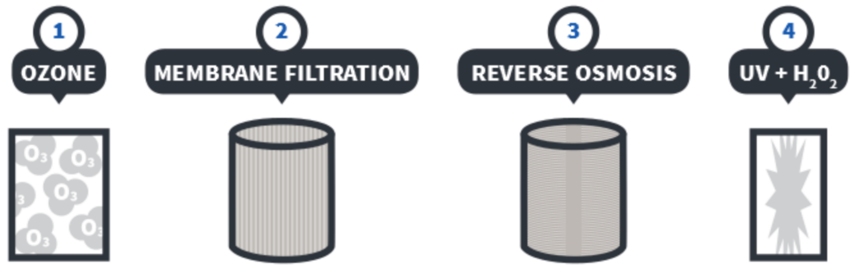
17%

Urban Storm Water Runoff

Pure Water Monterey
A Groundwater Replenishment Project

ADVANCED PURIFICATION TECHNOLOGY

Indirect potable reuse occurs in many communities in the Southwest United States and around the world. Protecting public health and safety is paramount, and PWM utilizes a four-step advanced purification treatment process to meet or exceed all state and federal drinking water regulations.



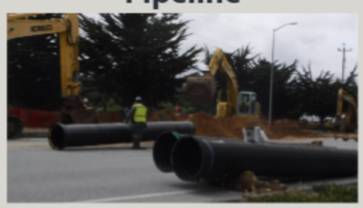
PROJECT COMPONENTS

PWM has four distinct project components. Overall project construction is nearing completion with water delivery to the Seaside Groundwater Basin expected to occur in late summer / early fall of 2019.

Source Waters

Advanced Water Purification Facility

Conveyance Pipeline



Basin Injection Wells

COOPERATIVE SOLUTIONS

PWM is a multi-benefit, regional project. In addition to creating a new drinking water source for the Monterey Peninsula, the Project also:

+ Increases available water for ag irrigation
+ Removes impaired waterways (ag drainage water) from the environment
+ Restores river habitats by reducing extraction from the Carmel River and decreasing pollutants flowing to the Salinas River

These regional benefits have created a network of project partners helping make PWM possible!

Water Reuse Case Study

City of Roseville

Sector: Municipal Utility

Subsector: Wastewater utility

Location: Roseville, CA

Water Source(s): Muncipal wastewater

Water Use(s): Irrigation, industrial, and future groundwater augmentation

Technology: Tertiary wastewater treatment and future advanced treatment

Water Recovered: 4 MGD annual average

Project Costs: $25 million for advanced treatment

Implementation Date: 2020

EPA-816-F-XXX **September 2019**

Overview and Drivers

Roseville is an inland Northern California community of approximately 140,000 residents and has been recycling tertiary CA Title 22 water for nearly 20 years. Roseville's primary source of drinking water is a federally operated surface water reservoir designed and used primarily for flood control. Presently 20% of all wastewater treated, about 1 billion gallons per year, is recycled for irrigation and industrial needs. Roseville's traditional surface water supply is challenged by significant past and projected population growth as well as environmental demands, climate change and periodic drought. Increasing water recycling is among the strategies Roseville plans to meet this water supply challenge. However all economically viable recycled water needs are being met presently through a traditional purple pipe distribution system. In order to improve recycled water utilization, significant changes to the recycled water program are needed.

Roseville has successfully employed aquifer storage of potable surface water which provides storage and groundwater management capability when surface water is plentiful to ensure that groundwater is always a viable backup water supply. A similar strategy is envisioned for recycled water.

Process or Technology

To utilize its groundwater aquifer for seasonal storage of recycled water and improve distribution options to new areas of the City, Roseville must employ advanced treatment to create indirect potable reuse opportunities. CA presently requires that reverse osmosis (RO) be part of any advanced treatment process unless an alternative is shown to provide equivalent water quality. As an inland community without access to an ocean discharge, the brine waste generated by RO cannot be disposed of economically thereby eliminating RO as a treatment option for Roseville.

To meet this challenge, Roseville will pilot alternative advanced treatment that incorporates ozone biologically active filtration (BAF), in addition to other processes needed to meet water quality based criteria. Benefits of including ozone-BAF in the treatment train include lower energy requirements, no brine disposal and improved removal of certain CECs.

Once treatment is proven, a system of injection and recovery groundwater wells can be utilized to store and recover advanced treated water in nearly all areas of the City.

Outcomes and Benefits

The ultimate goal of this effort is to fully utilize all available recycled water to maximize the City's water supply reliability and ensure the groundwater aquifer remains a healthy backup to the City's strained surface water supplies. By maximizing storage opportunities, Roseville believes that water shortages can be eliminated through management strategies even when drought conditions exist. Through increased Roseville reuse, more surface water remains to meet environmental and human water supply needs elsewhere. Proving an alternative advanced treatment option also allows other inland CA communities to benefit from increased water management options.

Challenges and Solutions

The key challenge for Roseville is to dramatically increase recycled water storage and use options. Roseville understands that the proposed alternative treatment train does not conform to current CA regulations for indirect potable reuse via groundwater replenishment. The first challenge is to demonstrate that an alternative treatment technology can deliver the same water quality as the presently accepted FAT process.

With advanced treatment and storage, a network of groundwater injection wells would allow advanced treated water to be stored in the aquifer when supply exceeds demand. The aquifer can then be used to "distribute" stored recycled water to all areas of the City using recovery wells. This eliminates the need for a recycled water pipe distribution network, allows the City to provide "recycled water" to areas that are not presently served, and ensures that the aquifer's water is not depleted and remains available to backup surface water supply.

Acknowledgements

Kenneth Glotzbach, PE
City of Roseville, CA
kglotzbach@roseville.ca.us

Marisa Tricas, MS
City of Roseville, CA
mtricas@roseville.ca.us

Todd Jordan, PE
City of Roseville, CA
tjordan@roseville.ca.us

References

Water Environmental Reuse Foundation (WE&RF), 2017. Final Report: Controlling Trace Organic Contaminants Using Alternative, Non-FAT Technology for Indirect Potable Water Reuse.

WateReuse Research & National Water Research Institute, 2013. Examining the Criteria for Direct Potable Reuse.

City of Altamonte Springs-Florida, Project: *pureAlta®*

International and National Awards

Sector: Municipal

Subsector: Potable Pilot project

Location: Altamonte Springs, Seminole County, Florida

Water Source(s): Effluent from the City of Altamont Springs WRF

Water Use(s): Proposed Potable

Technology: Advanced treatment

Water Recovered: Currently able to treat up to 28,800 gpd, scale up to 500,000gpd.

Project Costs: pureAlta® is co-funded with the St. Johns River Water Management District (SJRWMD) under its REDI Community & Innovative Cost-Share program. SJRWMD is contributing 50 percent of the $1 million construction cost for the project. pureAlta® is one of two potable reuse projects to be funded under this program.

Implementation Date: on or about 1994

Overview and Drivers

City of Altamonte Springs proactively created pureAlta® to address their community's future water needs and diversify the City's water portfolio. The project utilizes cutting-edge technology to purify reclaimed water to drinking water standards. Due to population increases and dwindling Floridan aquifer levels, experts have long predicted the state will not have enough groundwater to satisfy the public's drinking water needs.

Process or Technology

The advanced treatment process includes the following components: ozonation and biological activated carbon filtration (O3/BAF), ultrafiltration (UF), granular activated carbon filtration (GAC) and ultraviolet light with advanced oxidation process (UV AOP) all coupled with advanced system monitoring techniques.
The source flow used for this process comes directly from the effluent train of the City of Altamont Springs WWTF/DPR, operating under NPDES permit # FL0033251. It is currently returned to the effluent discharge and released. This is only a pilot project.

Outcomes and Benefits

The resulting purified water is tested to ensure it meets drinking water standards and removes pharmaceuticals and personal care products (PPCPs) which are not currently regulated. The potable reuse pilot project will treat approximately 28,800 gallons per day (gpd), which is less than 1 percent of the total water currently produced in the City (6 MGD). If the pilot project is successful, they might build a full-scale treatment system with a capacity of 300,000 to 500,000 gpd (approximately 5 percent of the City's future water demand, 9 MGD) to provide a purified water supply that supplements the City's drinking water system.

The pilot project is operating in a testing phase. During this testing, the purified water is blended with reclaimed water from the Water Reclamation Facility and beneficially reused for irrigation in the City's existing urban reclaimed water system. In the future, based on the success of the pilot, the City might build a full-scale treatment system to produce purified water to supplement the City's drinking water system by up to five percent.

Challenges and Solutions

Funding and design; regulatory rules (WQ) criteria. Facility space came from repurposed storage building on-site. Component selection.

Acknowledgements

EPA Region 4 staff (Pamala Myers) completed this template and acknowledges the City of Altamonte Springs management and staff.

References

www.altamonte.org/754/pureALTA, EPA PQR draft-report 2018.

Emory University, Atlanta, GA Project: WaterHub, Hydroponic Reactor Design

Sector: Institution/Commercial collaboration

Subsector: Non-Potable

Location: Atlanta, GA. Campus of Emory University.

Water Source(s): Effluent from Emory

Water Use(s): Campus Chiller Plants, Steam Plant, Toilet Flushing

Technology: Hydroponic w/ Submerged Fixed-Film Reactors, Reciprocating Wetland

Water Recovered: The WaterHub has processed over 150 million gallons of water.

Project Costs:

Implementation Date: May 2015

Overview and Drivers

Emory stated: In the last decade, Atlanta has witnessed numerous water related stresses, including: severe drought, EPA mandates to resolve critical infrastructure failures and an extended political dispute over water rights in the so-called "Tri-State Water Wars." As a result of these challenges, Emory University set out to explore ways to minimize its impact on community water resources and the environment with a more strategic and impactful water management solution: campus wide water reclamation and reuse.

Process or Technology

Sustainable Water designed Emory's reclamation system, the WaterHub, to integrate into the existing campus framework using two small parcels near Chappell Park Field. Up to 400,000 gallons of wastewater is mined directly out of the campus sewer system daily. Water is cleaned to Georgia Reclaimed Water Standards through an energy efficient, eco-engineered treatment process supported by solar (PV) energy production. The system has 50,000 gallons of clean water storage capacity, providing N+1 redundancy for campus district energy systems. Recycled water is distributed to multiple utility plants and select dormitories for toilet flushing via a 4,400 linear foot "purple pipe" distribution system. The system reduces Emory University's draw of potable water by up to 146 million gallons annually.

Outcomes and Benefits

The first system of its kind installed in the United States, the WaterHub® is a decentralized, commercial-scale water reclamation and reuse system serving Emory University's main campus just outside of Atlanta, GA. Producing up to 400,000 gallons of reclaimed water per day, the WaterHub mines wastewater directly from the campus sewer system and utilizes ecological treatment processes to treat the wastewater for beneficial reuse. The system recycles up to two-thirds of campus wastewater for non-potable demands including heating, cooling and toilet flushing. Moving the field of water reclamation forward, the WaterHub serves as a model for commercial-scale sustainable water management in urban areas.

The WaterHub enables the University to reduce its draw of potable water by up to 146 million gallons annually – displacing nearly 40% of total campus water demand. The system enhances campus resiliency by providing a consistent, reliable and redundant source of water for extensive non-potable demands and critical heating and air conditioning needs. The WaterHub is designed to de-risk campus operations from potential water service disruptions resulting from drought and aging municipal water infrastructure.

The WaterHub was made possible through an innovative Water Processing Agreement (WPA). The WPA allowed Sustainable Water to fully design, construct and operate the WaterHub at no capital expense or development risk to the University. The WaterHub creates lower cost water at a long-term stable rate and is expected to save millions of dollars in water utility costs to Emory over a 20-year period. The WaterHub aligns with the University's vision for a sustainable campus and reduces the overall water demand on one of the smallest municipal watersheds in the United States.

Challenges and Solutions

The WaterHub reduces Emory University's draw of potable water by up to 146 million gallons annually. WaterHub is designed to promote research and community outreach, enhancing the concept of the campus as a "living laboratory." With built-in lab space and easy access ports for water quality testing, the facility enables research in a variety of topics. The lower site also includes a demonstration reciprocating wetland system (ReCip®) as a showcase to visitors interested in other sustainable treatment technologies. The WaterHub at Emory University has earned 14 awards and has been featured in numerous publications such as **District Energy, Industrial WaterWorld, Sustainable Business Magazine, Georgia Operator, Treatment Plant Operator** and **CE News.**

Acknowledgements

EPA Region 4 staff (Pamala Myers) completed the template with information from The WaterHub @ Emory

References

http://sustainablewater.com/sw-overview/the-waterhub-at-emory/ http://sustainablewater.com/resources/frequently-asked-questions/

Water Reuse Case Study
Example Prototype Only

Indiantown Cogeneration Facility

Sector: Industrial

Subsector: Thermoelectric

Location: Indiantown, Florida
Water Source(s): Surface water, saline groundwater, and treated municipal water.
Water Use(s): Reuse within facility. Better water quality discharge.
Technology: Zero liquid discharge with use of microfiltration and reverse osmosis.
Water Recovered: Not available
Project Costs: not available
Implementation Date: 2012

Overview and Drivers

The Indiantown facility was using a zero-liquid discharge (ZLD) system using two brine concentrators to process the cooling tower blowdown water. These concentrators were expensive to maintain, used a load 1.4 Mega Watt Hour (MWH) electricity, and produced a high-volume waste water stream. Due to expensive maintenance, the facility decided to replace the concentrators with ZLD system consisting of Microfiltration (MF) and Reverse Osmosis (RO). The new ZLD system is less expensive to maintain and has lower wastewater discharges which returned a higher volume of filtered water back into the facility.

Process or Technology

In a typical application of MF, the incoming water passes through several thousand spaghetti-like hollow fiber polymeric membranes that remove suspended solids and bacteria. For removal of dissolved solids, the treated water from the MF unit passes through the spiral-wound RO membranes. This technology is employed before the demineralizers. The pores in the RO membrane are only a few angstroms in size and can remove a majority of the dissolved salts.

The brine concentrators were replaced by MF/RO systems in the ZLD system achieving higher quantities of filtered water.

Outcomes and Benefits

A typical cooling tower (500 ton, running 24 hours day,365 days per year) will flush over 3.9 Million gallons of water each year. Through use of ZLD systems, electric generation facilities can reuse a bulk of this wastewater stream. The new ZLD system used by the Indiantown facility helped increase the filtered water volumes, reduced maintenance cost for the facility and saved on 1.4 MWH electricity used in the old system. The new system was more effective in using briny groundwater from aquifers which are not sources of drinking water reducing reliance on fresh stream water.

Challenges and Solutions

The system encountered problems with microbiological fouling and scaling in second stage RO. These were resolved by introducing microbicide and lowering the pH of water to 5.

Acknowledgements

EPA Region 4 staff (Khurram Rafi) completed the template based on information from the following web references below.

References

https://www.waterworld.com/municipal/technologies/article/16211541/zld-treatment-of-cooling-tower-blowdown-with-membranes