

WATER RECLAMATION MANAGING OUR WATER INVENTORY

SUMMARY

How can San Diego County reservoirs get refilled without water imports and without rain? Currently over 85 percent of our water is imported from Northern California and the Colorado River. Our demand has grown as our needs have steadily increased. The question of future supply has plagued local water officials for decades. Conservation programs throughout the region have been in place for some time. The City of Carlsbad has been developing a desalinization plant for direct conversion of seawater. But another idea has come forward in recent times.

This new possible answer is being tested at the North City Water Reclamation Plant (NCWRP) in Kearny Mesa. A pilot program at NCWRP is the Advanced Water Purification (AWP) facility. This project promotes a bold objective: re-process and purify as much of this reclaimed water as feasible. What then?

Simply stated, but not without challenges – send this purified water back to our own reservoirs. Augmenting reservoirs this way can help reduce water imports, which are coming at ever-increasing costs. This concept, including the many technological innovations involved, is worthy of commendation.

DISCUSSION

Current Situation

The process of wastewater “reclamation,” is complex and multi-part. The Demonstration Project diagram in the Attachment gives some hint of how intricate this scheme is.

At present, City and County agencies re-process some wastewater for residential/business use. “Purple piping” systems are familiar, but are not used everywhere. These are strictly for landscape irrigation and certain industrial uses. But most of such effluent, after being processed to secondary standards, gets deposited into the Pacific Ocean.

Eventually, water reclaimed by the AWP is intended to be pumped to the San Vicente Reservoir. From there the water story is familiar. Reservoir inventory is processed and finally distributed back to us.

Conventional Methods

Located near Miramar, NCWRP is the first large-scale water reclamation plant in San Diego’s history. Processing capacity is 30 million gallons per day. These initial steps are similar to those in use throughout the county for many decades. NCWRP’s set-up is outlined here:

Primary Sedimentation: Untreated wastewater enters a chamber where four large pumps lift it ninety feet to the “head works.” All subsequent steps follow gravity flow to help limit energy use. Heavier solids sink to the bottom of the processing chamber while lighter materials (scum) float to the surface. A “chain and flight” system (a group of chains orbiting though the tank) scrapes debris toward a removal area. Both sediment and floating surface scum are removed, dried, and disposed off-site. This process, known as sedimentation, removes 90 percent of the settled solids, 50 percent of the suspended solids, and reduces Biological Oxygen Demand (BOD) by 25 percent. BOD measures water contamination that is putrescible (capable of further decay). High BOD is contaminated water; low BOD is good.

Aeration: Here the main players are a mixed population of “friendly” microorganisms. Both anoxic (oxygen depleted) and aerobic (oxygen is available) bacteria consume soluble BOD. Hydrogen sulfide, the odor of rotten eggs, and other foul-smelling gases, however, are unwelcome bi-products. Odor control “scrubbers” lift this foul air away, which then passes through a bleach solution spray. Past the scrubbers, air passes through carbon filters. These collect any remaining odors.

At this stage, water has been treated to Secondary Effluent Quality. It meets National Pollutant Discharge Elimination System (NPDES) standards, suitable for discharge into natural water courses, including the ocean. From here it may undergo further clarification or be pumped to the Point Loma Wastewater Treatment Plant, which accepts such water for disposal. Most of this water simply gets drained to the ocean. But some gets processed even further.

Chlorination: Tertiary water reclamation takes filtered, secondary effluent and places it into chlorine holding tanks for 90 minutes. Proper disinfection makes it ready for use in irrigation, equipment operation, or other business/industrial applications. Further, it may be de-mineralized by electro-dialysis reversal (EDR) for saline removal. At this stage, we reach purple pipe use.

One NCWRP objective is to minimize power consumption. The North City Reclamation Facility operates on power generated at its cogeneration plant. The plant fuel is methane gas, both from the Miramar Landfill and its own digesters. This conservation provides up to 75 percent of the overall power used. Any excess power, such as during off-peak periods, gets sold back to the grid.

Advanced Water Purification Facility Demonstration Project (AWP)

A portion of the Water Reclamation Plant output passes into the Advanced Water Purification Facility Demonstration Project (AWP). As shown in the Attachment, AWP adds three additional treatment barriers: (1) Membrane Filtration, (2) Reverse Osmosis, and (3) Advanced Oxidation with Ultraviolet Disinfection and Hydrogen Peroxide treatment.

All along, project staff has studied the feasibility of purifying water to augment our drinking water supply. Ultimately, they hope to demonstrate this water meets all quality, safety, and regulatory requirements.

- (1) Membrane-Filtration Barrier: The process begins. Here the effluent passes through two types of membrane filtration systems, Micro-filtration and Ultra-filtration. (These two methods are under study to determine which is most effective.) Both methods use a series of membrane filtration canisters that remove and/or destroy any remaining contaminants in the recycled water. Hollow fibers are employed to block unwanted materials, such as suspended solids, bacteria, and protozoa. The cloudiness disappears. Only dissolved organic solids and salts remain in the water.
- (2) Reverse Osmosis (RO): This stage forces water under high pressure through membranes with pores so small they can only be seen through a microscope. RO removes particles that are 50,000 times smaller than the smallest bacteria and viruses. Many bottled water companies use this same process.
- (3) Ultraviolet Disinfection/Advanced Oxidation: Ultraviolet light and hydrogen peroxide work together. During this stage a high intensity light, similar to concentrated sunlight, reacts with Hydrogen Peroxide, which combines with the light and disinfects the water. After doing their work, these chemicals break down into water and oxygen.

Processing is now complete. Only pure water remains.

San Diego County's Water Future

Eventually, the Advanced Purified Water is intended to reach the San Vincente Reservoir (SVR) and blend with reservoir inventory. SVR water, as is reservoir water anywhere in the County, gets further treated before supplying San Diego or any other city. At present, no AWP water is being sent to SVR for storage.

The AWP test system produces approximately one million gallons of purified water each day. For now this high-quality product is reused as a purple pipe asset, but it can do much more. Key approvals are still pending that may open the gateway for a fundamentally more important use. A full-scale AWP could produce up to 16 million gallons each day.

Other California communities purify reclaimed water, then re-inject into local aquifers, an approach called "groundwater recharge." San Diego County lacks suitable aquifers of any size.¹ But we do have reservoirs, such as San Vincente.

¹ <http://www.sdcwa.org/sdcwa.org/groundwater>

Phase 2 of the Water Purification Demonstration Project (Attachment) was approved by the San Diego City Council in the 2009. The City of San Diego's water resource strategy includes planning, conservation, re-cycled water, ground water, watershed, resource protection, and water reuse.

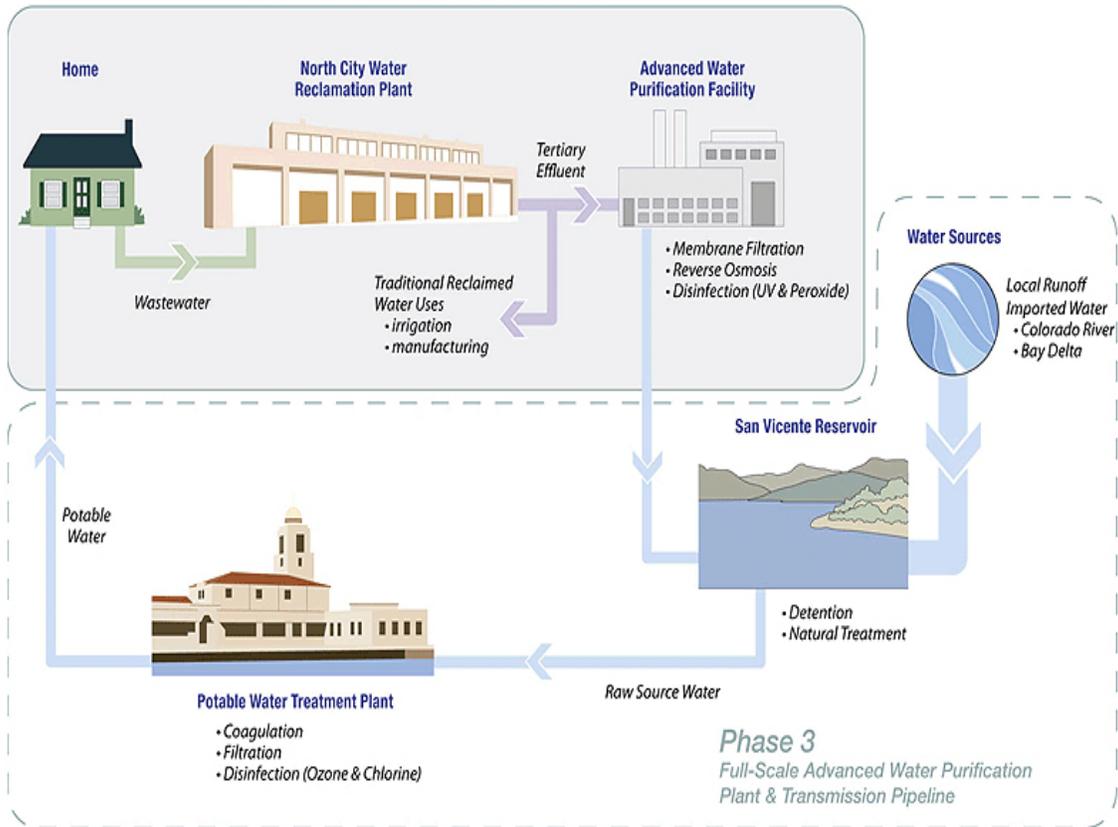
The time has come to consider implementation of innovative concepts, such as shown by the Advanced Water Purification Demonstration Project. When this project receives its needed approvals, San Diego County may take yet another step toward water self-sufficiency. Phase 3 as outlined in the diagram shows how the grand design concept of reservoir augmentation would come full circle.

COMMENDATION

The 2011/2012 San Diego County Grand Jury commends Kearney Mesa's Advanced Water Purification Facility for its conceptual design, innovative use of technology, and determined implementation. Advancing to a full-scale water reclamation facility is the face of forward thinking for San Diego in meeting its all-important water needs.

City of San Diego's
Demonstration Project
 Water Purification Demonstration Process

Phase 2 Demonstration-Scale Project



Multi-Barrier Water Treatment Steps

