THE CITY OF SAN DIEGO

# M E M O R A N D U M

DATE: January18, 2012

TO: Natural Resources and Culture Committee - Agenda of February 1, 2012

FROM: Roger Bailey, Director of Public Utilities

SUBJECT: Monthly Update on the Indirect Potable Reuse/Reservoir Augmentation Demonstration Project

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On October 19, 2011, the Public Utilities Department provided an update on the Indirect Potable Reuse/Reservoir Augmentation Demonstration Project (Demonstration Project) to the City Council's Natural Resources and Culture Committee (ITEM-5A). This is a progress report containing first quarter water quality results of the Advanced Water Purification Facility (AWP Facility), an update on education and outreach efforts, and information requested by Committee members.

## Background

To investigate the feasibility of Indirect Potable Reuse/Reservoir Augmentation, the City Council voted in 2007 to approve the Water Purification Demonstration Project. The intent of the Demonstration Project is to establish the technical, water quality, environmental, public outreach, regulatory, and funding requirements necessary to implement a full-scale project.

The pilot testing facility, referred to as the Advanced Water Purification Facility (AWP Facility), has been operational since June 2011. During this time, the advanced treated water is tested frequently to determine the effectiveness of the treatment equipment in removing contaminants and to gather and analyze data for operation refinement.

## Testing and Monitoring

The AWP Facility is being operated in accordance with the Testing and Monitoring Plan. The Plan's key objectives are to demonstrate the proposed advanced purification technology meets all drinking water standards and poses no threat to public health; demonstrate reservoir water quality can be maintained; implement a monitoring plan for

chemicals of emerging concern that is tailored to the wastewater received at the North City Water Reclamation Plant; and demonstrate integrity monitoring techniques and performance reliability measures for all of the treatment equipment.

The Draft Testing and Monitoring Plan was prepared with guidance from the California Department of Public Health's (CDPH) Draft Groundwater Recharge Reuse Regulations (August 2008), previous reports from the project's Independent Advisory Panel (IAP), and the State Water Resources Control Board's Final Report on *Monitoring Strategies for Chemicals of Emerging Concern in Recycled Water, Recommendations of Science Advisory Panel (June 2010).* The Plan was then finalized based on comments from the IAP, CDPH, and the Regional Water Quality Control Board.

**Equipment Integrity and Monitoring**

Integrity and Monitoring testing was conducted at each step in the water purification process. Equipment integrity is tested on both a continuous basis through online water quality instruments, as well as through daily on-site testing. The equipment – membrane filtration, reverse osmosis, and ultraviolet disinfection/advanced oxidation - have demonstrated excellent performance and have shown no integrity issues. The results indicate the equipment is performing well and is providing effective treatment barriers.

**Water Quality Results**

First quarter (August – October) water quality testing data of the AWP Facility was received in November 2011. The test water was sampled for more than 300 compounds, which included all regulated drinking water contaminants, all contaminants under consideration for regulation, microbial contaminants, and potential disinfection byproducts (DBPs).

The advanced purified water was also sampled for 91 constituents of emerging concern (CECs), which are not currently regulated. Only two CECs were detected at an average of thirty parts per trillion or less. One part per trillion is equivalent to one drop of water in 20 Olympic-sized pools. The water quality data indicated the purified water met all federal and state drinking water standards and was of better quality than imported water sampled in the same timeframe.

The Independent Advisory Panel reviewed the water quality results and provided feedback at a workshop conducted on December 19, 2011.

**Outreach**

Educational and outreach efforts continue to create an enriched landscape of informed individuals with presentations, facility tours, utilization of social media and video. To date, 128 Demonstration Project tours and presentations have been conducted for 1,697

guests. On December 2, 2011, during a tour for the Catfish Club, a member was recognized as being the 1,500th visitor to partake in the tour experience.

In an effort to accommodate all guests, a virtual tour video was developed to reach those that cannot tour in person and also to increase awareness and understanding of the project. The video may be seen on the project website, City TV and YouTube. The video link was also distributed to more than 2,000 interested parties on the project email list, and DVDs are available to educators wishing to utilize the information in the classroom.

**Information Request**

During the October 19, 2011, NR&C meeting, Councilmember Lori Zapf requested information on other agencies or organizations actively participating in Indirect Potable Reuse. The public has also raised this issue in the past so, in response, project staff penned a white paper on the subject. The white paper is available on the project website, purewatersd.org, and is attached to this memo for the Committee's review.

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Director of Public Utilities

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Attachment: Potable Reuse Projects in the United States

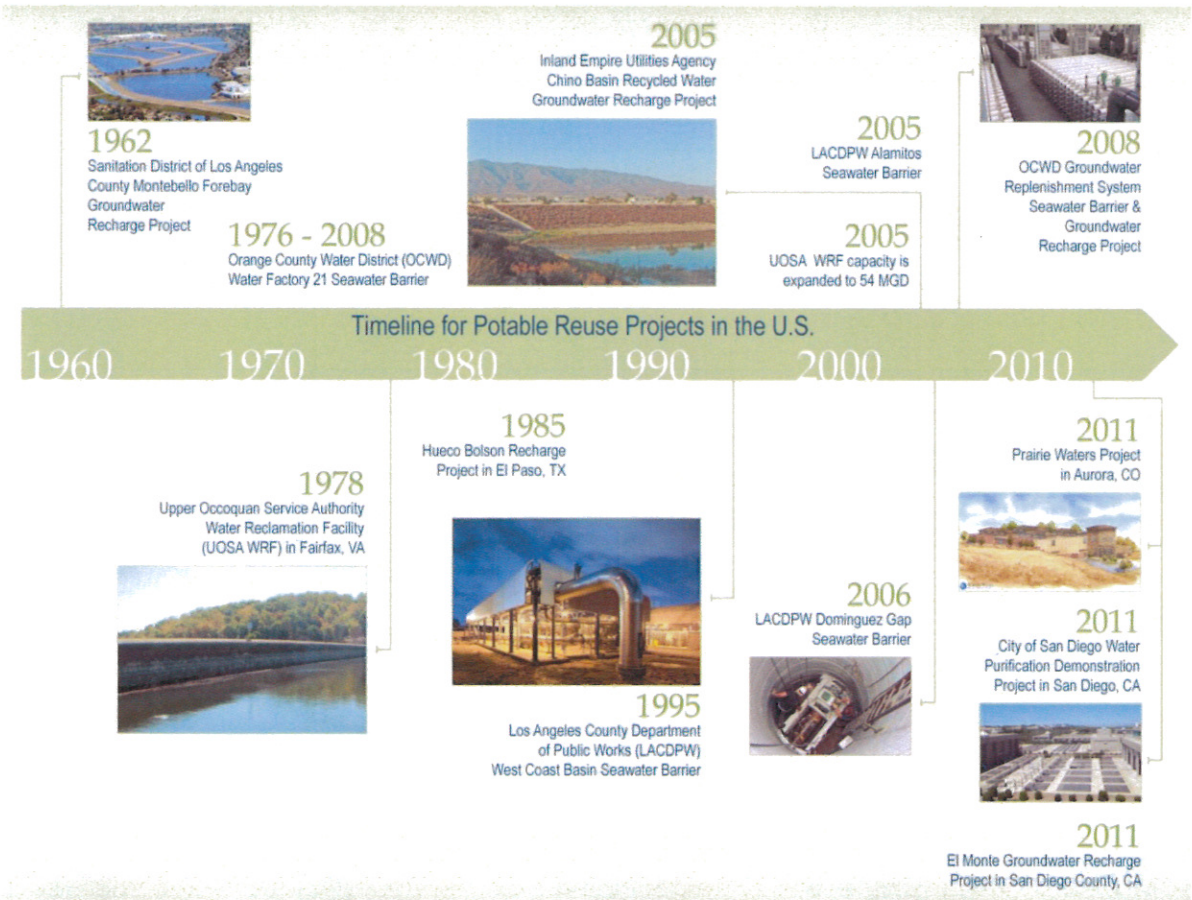
cc: Marsi A. Steirer, Deputy Director

## POTABLE REUSE PROJECTS IN THE UNITED STATES

The water cycle—the continuous movement of water from ocean to air and land and back to the ocean—is as old as the earth itself. The basic underlying principle is simple: All water is recycled. There is no new water.

Throughout the developed world, wastewater has been collected and treated for return to the environment where it receives further treatment thanks to sunlight, time, and nature, prior to being used again. Today, nature cannot keep up with all the water needs of people, industry and agriculture, especially in arid regions like Southern California. As a result, human beings have accelerated this process with advanced water purification systems which, combined with natural treatment occurring in groundwater or surface water bodies, make up *potable reuse*. Advanced water purification includes additional treatment beyond tertiary for further removing constituents of concern to public health. This may include membrane filtration, reverse osmosis and advanced oxidation (WateReuse, n.d.).

This white paper presents key potable reuse projects that have been implemented in the United States beginning in the 1960s. It should be noted that almost all of these projects occur in areas with limited or no surface water reservoir storage capacity and, as such, the treated water is used to recharge groundwater aquifers. Projects that discharge into rivers or reservoirs (surface water augmentation) include the Upper Occoquan Service Authority project in Fairfax, Virginia and the Prairie Waters Project in Aurora, Colorado. A summary timeline and key fact tabulation is presented below.



## Potable Reuse Project Details

| Project | Level of Treatment | Start Year | WRF Rated Capacity (MGD) | Actual Delivery (AFY) |
|---|---|---|---|---|
| LACSD Montebello Forebay Groundwater Recharge Project[1], Los Angeles County, CA | Tertiary with Soil Aquifer Treatment | 1962 | 47.5 | 50,000 |
| OCWD Water Factory 21 Seawater Barrier, Orange County, CA | Tertiary with Microfiltration and Reverse Osmosis | 1976 | 15 | 17,000 |
| UOSA Occoquan Reservoir Indirect Potable Reuse[2], Fairfax, VA | Tertiary with High-lime Process, Chlorination & Dechlorination | 1978 | 54 | 47,000 |
| Hueco Bolson Recharge Project, El Paso, TX | Tertiary with Activated Carbon, Lime Process, Ozone Disinfection | 1985 | 10 | 2,000 |
| LACDPW West Coast Basin Seawater Barrier[3], Los Angeles County, CA | Tertiary with Microfiltration, Reverse Osmosis & UV | 1995 | 30 | 5,000 |
| LACDPW Alamitos Seawater Barrier[4], Los Angeles County, CA | Tertiary with Microfiltration, Reverse Osmosis & UV | 2005 | 3 | 3,000 |
| IEUA Chino Basin Groundwater Recharge Project[5], San Bernardino County, CA | Tertiary with Soil Aquifer Treatment | 2005 | 84.4 | 10,000 |
| LACDPW Dominguez Gap Seawater Barrier[6], Los Angeles County, CA | Tertiary with Microfiltration and Reverse Osmosis | 2006 | 4.5 | 1,000 |
| OCWD GWRS Seawater Barrier & Groundwater Recharge Project, Orange County, CA | Tertiary with Microfiltration, Reverse Osmosis & AOP | 2008 | 70 | 75,000 |
| Aurora Prairie Waters Project, Aurora, CO | Riverbank Filtration, Advanced UV Oxidation, GAC Adsorption | 2011 | 50 | 10,000 |

Notes:
[1] Recycled water is provided by Sanitation Districts of Los Angeles County's Whittier Narrows and San Jose Creek (100 MGD) WRFs.
[2] Recycled water is provided by the regional Upper Occoquan Service Authority's WRF.
[3] Recycled water is provided by Water Replenishment District that is purchased from West Basin MWD Edward C. Little WRF. It is blended with MWD imported water.
[4] Recycled water is provided by the Water Replenishment District of Southern California's Long Beach WRF (Tert.) and Leo J. Vander Lans WTF (Adv).
[5] Recycled water is provided by four Inland Empire Utility Agency water reclamation facilities; Regional Plants Nos. 1, 4 and 5 and the Carbon Canyon WRF.
[6] Recycled water is provided by the Los Angeles County Flood Control District's Terminal Island Treatment Facility.

Following are brief descriptions of key groundwater replenishment and surface water augmentation projects using advanced purified water that are currently in operation.

**Los Angeles, California: Montebello Forebay Groundwater Recharge Project**

The Sanitation Districts of Los Angeles County (LACSD) manage the Montebello Forebay Groundwater Recharge Project, one of the oldest ongoing natural groundwater recharge projects in the nation. LACSD has managed the project, located in southeastern Los Angeles County, since 1962.

The Montebello Project provides advanced secondary treatment (partial denitrification) and tertiary filtration/disinfection for an average of 45 MGD of water prior to spreading in basins in the Montebello Forebay area of the Los Angeles Central groundwater basin. This advanced purified water makes up about 35 percent of the total recharge to the groundwater basin, while imported water purchased from the Metropolitan Water District of Southern California and storm water runoff make up the remainder of the water used to replenish the basin, which provides water for 3.7 million people.

The Montebello Project is important because its long duration—40 years—has allowed numerous health studies that confirm the safety of groundwater replenishment projects. A heavily peer-reviewed health

effects study conducted in 1976 found no measurable health issues among the people consuming the water. In 1996 and 1999, the Rand Corporation conducted epidemiological studies on the Montebello project examining the health outcomes of about 900,000 people. The conclusion reached by the Rand researchers was that after 30 years of consumption of advanced purified recharge water there was no association between project water and any ill health effects.

**Fairfax, Virginia: Upper Occoquan Service Authority, Millard H. Robbins, Jr. Water Reclamation Facility**
After an intensive study conducted in 1970 of water quality problems in the Occoquan Reservoir, a major source of drinking water for Northern Virginia, the Occoquan Policy (Policy) mandated the creation of an advanced water purification facility to replace the 11 secondary treatment plants discharging to the reservoir. The Policy also mandated the creation of an independent ongoing program of water quality surveillance. The Upper Occoquan Service Authority (UOSA) was created to meet the water recycling mandate of the Policy. The Occoquan Watershed Monitoring Laboratory met the requirement for independent surveillance.

The UOSA regional advanced water purification facility includes lime clarification, carbon adsorption, filtration, and chlorine disinfection. Originally a 27 MGD facility, UOSA WRF was expanded to 54 MGD in the 1990s and discharges to a final effluent reservoir prior to release to Bull Run, a tributary of the Occoquan Reservoir, about 20 river miles upstream of the water treatment plant intake. During times of normal precipitation, the advanced purified water from the UOSA WRF makes up about five percent of the total inflows to the reservoir, with percentages much higher (up to 90%) during times of drought.

**Orange County, California: Water Factory 21 and Groundwater Replenishment System**

Water Factory 21

From its inception in 1976, Water Factory 21 was the most recognized and highly-regarded water purification program in the water industry worldwide. It was the first project in California to use advanced water purification technologies, including reverse osmosis, to enhance secondary effluent to drinking water standards. Advanced purified water was injected into the Orange County groundwater basin in a series of wells used as a barrier against the intrusion of seawater into the basin. For over 30 years, Water Factory 21 protected the integrity of the large groundwater basin that serves northern and central Orange County while also helping to increase the reliability of the region's water supply. Water Factory 21 had a design capacity of 15 million gallons per day (MGD).

Groundwater Replenishment System

The Groundwater Replenishment System (GWRS) has been operational in Orange County since January of 2008. The GWRS replaced Water Factory 21 and expanded using a combination of membrane filtration, reverse osmosis, and advanced oxidation to address a new generation of emerging contaminants, including pharmaceuticals. The 70 MGD project, expandable to 100 MGD, purifies water to state and federal drinking water standards prior to serving the seawater injection barrier and a spreading basin recharging the Orange County groundwater basin. The underground basin provides more than half the water used by northern and central Orange County.

**El Paso, Texas: Hueco Bolson Recharge Project**

In order to decrease the rate at which the fresh water reserves of the Hueco Bolson were being depleted, El Paso Water Utilities looked to artificially recharge the aquifer using advanced purified water. The Hueco Bolson aquifer provides about 40 percent of the municipal water supply needs of El Paso, Texas and the surrounding area. It also supplies 100 percent of the municipal supply for Ciudad Juarez, Mexico and Fort Bliss, Texas. The Hueco Bolson receives limited natural recharge due to the arid climate. The 10 MGD Fred Hervey Reclamation Plant and the associated Hueco Bolson Recharge Project started full operation in 1985 and treats up to 7.5 MGD to drinking water standards for groundwater injection. The reclamation plant uses a 10-step treatment process including activated carbon, lime clarification, filtration and ozone disinfection.

**Scottsdale, Arizona: City of Scottsdale Water Campus**

Meeting the water supply demands of a growing city led to the creation of the Water Campus in Scottsdale, Arizona. Since 1998, the Water Campus has produced 12 MGD of tertiary treated recycled water that is used for golf course irrigation during the summer months. In winter, when irrigation is reduced, 10 MGD receives advanced purification at a state-of-the-art facility where microfiltration, reverse osmosis, and disinfection purify the water to drinking water standards before recharge into the local groundwater basin.

**Los Angeles County-Area, California: Seawater Barrier Projects**

Seawater intrusion is a natural and typical occurrence for all coastal aquifers around the world. Due to the severe over-draft of groundwater for potable and agricultural purposes in the Central and West Coast Basins (CWCB), seawater intrusion is contaminating the groundwater with salt and poses a serious threat to the local potable water source. To address this issue, fresh water consisting of imported and recycled water is injected into a well to build up pressure such that it overcomes the pressure of the intruding seawater, thereby blocking the intrusion. The Water Replenishment District of Southern California (WRD) currently manages three seawater intrusion barriers systems within Los Angeles County, all of which are operated by injecting imported potable or advanced purified water into a series of wells to maintain a freshwater barrier to protect against seawater intrusion. It is important to note that all seawater barrier projects are, in fact, potable reuse projects as well, as the injected water does eventually migrate into the drinking water source in the aquifer.

West Coast Seawater Barrier

The West Basin Municipal Water District's Edward C. Little Water Recycling Facility (ELWRF) in El Segundo, California, has been on-line since 1995. Secondary effluent from the City of Los Angeles Hyperion Treatment Facility is treated at the ELWRF to produce five different qualities of custom-made recycled water for irrigation, commercial and industrial use and groundwater recharge. For recharge, secondary treated effluent is purified by micro-filtration, reverse osmosis, and disinfected with UV disinfection. The advanced purified water is mixed with imported water prior to injection into the groundwater basin (West Coast) via a 100-well seawater barrier. Approximately 5,000 acre-feet of advanced purified water is injected into the seawater barrier annually.

Alamitos Seawater Barrier

The Alamitos Seawater Barrier receives recycled water from the Long Beach Water Reclamation Plant (LBWRP) that provides primary, secondary and tertiary treatment for 25 million gallons of wastewater per day. The plant serves a population of approximately 250,000 people. Approximately 5 million gallons per day of recycled water is reused at over 40 reuse sites for landscape irrigation of schools, golf courses, parks, and greenbelts by the City of Long Beach and the re-pressurization of oil-bearing sediment off the coast of Long Beach. A portion of the recycled water produced from the LBWRP undergoes advanced treatment at the Leo J. Vander Lans Advanced Water Treatment Facility. The facility uses microfiltration, reverse osmosis, and ultraviolet disinfection to produce high quality water that is blended with imported water and pumped into the Alamitos Seawater Barrier to protect the groundwater basin from seawater contamination. The WRD purchases all of the water injected into the barrier, except for about 2,500 acre-feet per year that is purchased by the Orange County Water District. In total, approximately 3,000 acre-feet of advanced purified water is injected into the seawater barrier annually.

Dominguez Seawater Barrier

The Dominguez Gap Barrier currently receives approximately 1,000 acre-feet per year of advanced purified water from the Los Angeles County Flood Control District (LACFCD) Terminal Island Water Reclamation Plant/Advanced Water Treatment Facility. They also operate and maintain the barrier. The plant treats wastewater from over 130,000 people and 100 businesses in the heavily industrialized Los Angeles Harbor area, including the communities of Wilmington, San Pedro, and a portion of Harbor City. The advanced purification facility can treat up to 4.5 MGD of tertiary effluent with microfiltration followed by reverse osmosis and chlorine disinfection. The advanced purified water meets all drinking water quality standards. It is also used as valuable boiler feed water for local industries in the Harbor area and offsets millions of gallons of potable water each day.

**San Bernardino County, California: Chino Basin Groundwater Recharge Project**

Water recycling is a critical component of the water resources management strategy for the Chino Basin in Southern California. Inland Empire Utilities Agency (IEUA) has implemented an aggressive water recycling program to complement dwindling imported water to meet its expanding needs. IEUA produces a very high quality recycled water that can be used for a wide variety of applications, including groundwater recharge, industrial process water, and irrigation of golf courses, freeway landscaping, pasture for animals and food crops. Presently, about 15 percent of the 60 MGD of water currently generated by the agency's four water recycling plants is reused locally each day. Recycled water received tertiary filtration and UV disinfection prior to conveyance and blending with stormwater flows in spreading basins prior to percolation into the groundwater basin.

**Aurora, Colorado: Prairie Waters Project**

Colorado's arid environment and cycles for drought make a drought-protected water supply a priority for many Colorado cities. Out of this need, the City of Aurora, Colorado developed the Prairie Waters Project. Anticipated to begin operation in 2011, the Prairie Water Project will increase the City's water supply by 20 percent, delivering up to 10,000 acre-feet (about 3.3 billion gallons) of advanced purified water per year. The project will draw river water from the South Platte River, a receiving water of treated wastewater effluent from wastewater treatment plants located upstream. The river water will be drawn through the sand and gravel of the riverbank and pumped to a 50 MGD water purification facility that treats the water using softening, advanced ultraviolet oxidation, filtration and granulized activated carbon adsorption. The advanced purified water will then be discharged into the Aurora Reservoir, the City's raw water storage reservoir. Water from the reservoir is treated again prior to distribution into the potable water distribution system.

**SIDEBAR**

**Planned Versus Unplanned Potable Reuse Projects**

Indirect potable reuse—using water a second time as a drinking water supply—occurs on both a planned and unplanned basis. San Diego's Water Purification Demonstration Project will demonstrate the safety associated with *planned* indirect potable reuse, which means that wastewater is purified to an extremely high level. The process includes state-of-the-art technological processes, including a combination of membrane filtration, reverse osmosis, and advanced oxidation.

*Unplanned* indirect potable reuse takes place on nearly every river system throughout the world, including the United States. Water that moves from an upstream community to one downstream varies in water quality depending on the quality of wastewater discharged along the way. So, treated wastewater is already being provided to many communities as part of their drinking water.

In the case of the City of San Diego, imported water from the Colorado River and Northern California contains treated wastewater discharged from a total of over 345 municipal wastewater facilities. All imported water and water collected in San Diego's reservoirs from rainfall is untreated or "raw" water. Before any of that water is sent to your tap, it is treated in a water treatment plant to ensure it is safe and healthy to drink – and that it meets all drinking water standards. San Diego could not exist without these imported water sources, which contain treated wastewater.

**References**

WateReuse. (n.d.). WateReuse Association website online glossary. Accessed on June 13, 2011. http://www.watereuse.org/information-resources/about-water-reuse/glossary-1