URBAN COAST

Special Issue: State of the Bay

Volume 5 Issue 1 *Article 1.1.0*

December 2015

Water Resources: Water Supply and Use from a Water Quality Perspective

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The *Urban Coast* multidisciplinary scientific journal is a product of the Center for Santa Monica Bay Studies, a partnership of Loyola Marymount University's Seaver College of Science and Engineering and The Bay Foundation.

Recommended Citation:
Cox, H., E.D. Stein, L. Protopapadakis, and M. Dojiri (2015). State of the Bay Report. "Water Resources: Water Supply and Use from a Water Quality Perspective." *Urban Coast* 5(1): 3-10.

Available online: http://urbancoast.org/

ISSN 2151-6111 (print)
ISSN 2151-612X (online)

1.1.0 Water Supply and Use from a Water Quality Perspective

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In our urbanized watershed, water can come from a variety of sources. It can come from rainfall and snowmelt that is captured, imported, and stored for use in our drinking water systems. It can be runoff captured for irrigation, mostly lost to the ocean via storm drains. It can be potable water discharged to the ocean as effluent from wastewater treatment plants after being used in our homes and industry, or as runoff after being used outdoors for landscaping. Each of these sources of water in the Santa Monica Bay Watershed is managed separately by different agencies. For example, in the City of Los Angeles, the Los Angeles Department of Water and Power (DWP) manages potable water, the Department of Public Works is responsible for managing runoff, wastewater treatment, and flood control, and the state's Los Angeles Regional Water Quality Control Board regulates the water quality of discharge to the receiving waters.

Despite this separation, one agency's management action can be affected by the decisions of a different agency. For example, reclaiming wastewater can reduce demand for potable water and decrease the amount discharged into receiving waters. Reducing outdoor water use can decrease runoff, and capturing runoff and using it onsite can also decrease demand for potable water. Conversely, one agency's activities can also create challenges for other agencies, such as when development and flood control efforts convert pervious surfaces into impervious ones, preventing rainwater from recharging underground aquifers, or when conservation efforts successfully reduce the volume of water disposed into the sewer system, but simultaneously increase the concentration of said wastewater, making it more challenging and expensive to treat.

Four years of drought in California have increased the focus on water supply and the urgency for agencies to work together to forge solutions that meet all of their collective mandates. Pressure to solve water shortages with traditional, single-minded solutions is still high. A better approach, however, would be to coordinate efforts across the different agencies. Australia provides an example of such collaboration. During the Millennium Drought in southeastern Australia, the city of Melbourne succeeded in reducing water consumption and rebuilding its water reserves, due in part to having one water management agency that oversees all aspects of water supply, use, and disposal (Grant et al. 2013).

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Where We Have Come From and Where We Are Going

Following the Australian example, the State Recycled Water Policy calls for increases in local water reuse through irrigation, groundwater infiltration, surface water augmentation (primarily in Northern California), and exploration of the feasibility of direct potable reuse. The state's goals are to increase the capture and use of stormwater by 500,000 acre-feet by 2020 and 1 million acre-feet by 2030 (relative to 2007 levels); increase use of recycled water by 1 million acre-feet by 2020 and 2 million acre feet by 2030 (relative to 2002 levels); and increase the amount of water conserved by 20% by 2020 (relative to 2007 levels) (SWRCB 2013).

Accomplishing this vision will require increased use of comprehensive water budgeting, which can help fulfill the current demand for water through a combination of traditional sources, wastewater reclamation, desalination, stormwater harvesting, and conservation. Moving forward, local groundwater and water reuse will likely be added to the conversation.

Traditional Sources

Traditional sources of water in the Santa Monica Bay Watershed come from local groundwater, imported snowmelt, and surface water from the Sacramento-San Joaquin Bay-Delta, the Colorado River, and to a lesser extent the Owens Valley. However, meeting water demands in southern California with traditional sources will be increasingly challenging due to projected longer and more severe droughts combined with less reliable imported water sources from the Colorado River and the Bay-Delta (California Natural Resources Agency et al. 2014).

Conservation

Municipalities have focused a lot of effort on public outreach to encourage water conservation and rainwater harvesting. The DWP and local municipal water districts have created a variety of programs that offer rebates and other incentives to encourage residential, commercial, and industrial users to reduce their indoor and outdoor water use, such as turf removal programs and rebates for installing water-efficient appliances (see Sidebar 1.1 for more).

1.1 Turf Removal: This practice requires replacing existing turfgrass with California drought-tolerant or permeable materials. The Metropolitan Water District is offering up to $2 per square foot, while the DWP is offering up to $3.75 per square foot. For availability of these residential and commercial rebates, check: www.socalwatersmart.com and www.ladwp.com/cf

These efforts appear to have been successful, as individual consumer water use has declined and potable water use in the region has remained relatively constant since the 1970s despite a growing population (LADWP 2011). Furthermore, many of these programs not only reduce water consumption for irrigation, but also wastewater discharge and dry-weather runoff caused in part by over-irrigation. This has reduced one source of contaminated discharge to the ocean and other surface waters such as rivers and creeks (Figure 1.1-1).

Low Impact Development and Rainwater Harvesting

Low Impact Development (LID) provides best management practices (BMPs) for many categories of residential, commercial, and industrial development and redevelopment projects with the goal of capturing and retaining on-site stormwater from a 0.75-inch 24-hour rain event, or an 85th percentile 24-hour rain event, whichever is greater. Typical BMPs used for rainwater harvesting and onsite infiltration are rainwater barrels, porous pavement, rain gardens, and vegetated swales (see Sidebar 1.2 for more). Well designed and constructed LID-based BMPs capture, infiltrate, or provide stored water for future use while simultaneously lowering the need for irrigation, reducing the demand on traditional water sources. In the best cases these landscape options can provide habitats for enhanced urban ecology benefiting native wildlife.

1.2 Rain Barrels and Cisterns: This stormwater practice is used to divert water flow from rooftops into a storage unit, such as a 50-gallon barrel or cistern, for saving and reuse. *Rebates available through LADWP and www.socalwatersmart.com.*

Permeable Pavements: Permeable pavements are materials or techniques that allow water to infiltrate through the surface while capturing solids and filtering pollutants. *For more information regarding Permeable Pavements visit this LA City Stormwater page.*

Rain Gardens and Bioretention: Rain gardens and bioretention basins are used to increase infiltration by diverting stormwater flow into shallow landscape depressions that may include annual or perennial plants for onsite pollutant removal. *For more information on Rain gardens/bioretention go to this EPA site. For information about designing a residential rain garden go to this Surfrider site.* ***For information on rain gardens constructed by the SMBNEP, go to The Bay Foundation site rain garden page***

Berms and swales: Berms and swales are designed with the contour of the land diverting the flow of water to desired locations like a vegetated area. A swale is a parabolic depression which holds the water, while a berm is the result of the walls of the swales. *For more information regarding Berms and Swales visit this EPA site.* ***For information on projects implemented by the SMBNEP, go to this TBF site.***

Although the primary goal is management of urban runoff, these types of BMPs also often provide esthetic enhancements and water conservation benefits, and can be implemented throughout an entire watershed. In the Bay's watershed, LID ordinances were first put in place in Los Angeles, Santa Monica, and unincorporated areas of Los Angeles County. Most other cities in the watershed have followed suit, partly driven by the need to meet the requirements of the recently renewed NPDES permit for the municipal separate storm sewer system which mandates all cities in the County of Los Angeles to have a LID ordinance or equivalent regulation by the end of 2014. These programs have the added benefit of reducing use of potable water for irrigation.

Stormwater Harvesting

Many cities along Santa Monica Bay and elsewhere in the County of Los Angeles are in the process of developing and implementing Watershed Management Programs or Enhanced Watershed Management Programs (EWMPs) to satisfy new permit requirements and to ensure compliance with Total Maximum Daily Load water quality regulations. The focus of the EWMPs is to identify and implement regional water quality improvement projects that capture and retain stormwater from 85th percentile storm events for infiltration, storage for irrigation, or other beneficial uses. These programs, including several run by the City of Los Angeles in collaboration with Los Angeles County and other cities in the watershed, plan to use a combination of large-scale, centralized stormwater capture facilities and smaller scale, distributed stormwater capture projects, such as green streets (bioswales), rain gardens, and rain barrels (for more see Sidebar 1.2 or visit LA's Stormwater Capture page). These multi-benefit projects will not only improve Santa Monica Bay's water quality, but will also aid in recharging our local groundwater supplies while conserving water.

Groundwater Treatment

Three groundwater basins exist within the Santa Monica Bay watershed. These are the West Coast Basin, Santa Monica Basin, and Hollywood Basin, of which the West Coast Basin is the largest. Water quality in these basins can be affected by seawater intrusion and contaminants from industrial, agricultural, and residential activities (Reed, DWP, pers. comm., 23 July 2015).

Of over 400 wells in operation in the West Coast Basin, 20 have been identified as high priority remediation sites due to chemical contamination. Contaminants of concern are primarily Volatile Organic Compounds (VOCs), although other pollutants including DDT, metals, and petroleum hydrocarbons are also present. Responsible parties have implemented fourteen groundwater remediation projects in the West Coast Basin, including three United States Environmental Protection Agency (EPA) Superfund sites, and plans for two more sites are underway (TODD Groundwater et al. 2015). Saltwater intrusion into the West Coast Basin is managed by the operation of two barrier systems where imported and recycled water are injected into the aquifers to maintain hydraulic pressure and prevent the intrusion of ocean water into the basin. Future efforts are focused on using 100% reclaimed water at the two barrier systems. In addition, two desalter projects have been implemented to help remove brackish groundwater from the basin (Reed, DWP, pers. comm., 23 July 2015).

Although Methyl tert-butyl ether (MTBE) and trichloroethylene (TCE) are no longer used, they are still concerns in the Santa Monica Basin. The City of Santa Monica installed new treatment facilities to remove MTBE contamination from local wells, and in 2011, began to meet 50% of its water use with local groundwater. Additional groundwater treatment facilities for treatment of TCE and perchloroethylene (PCE) are currently being pilot tested, with full-scale facilities anticipated to be in place by 2020. Santa Monica is hoping to reach self-sufficiency by 2020 by fully utilizing its local groundwater supply and aggressive conservation actions (Cardenas, Pers. Comm., 3 August 2015). The Hollywood Basin contains four sites contaminated with Total Dissolved Solids and one site contaminated with arsenic. The City of Beverly Hills pumps from this basin, but shuts down the well when water being pumped out of it reaches levels of concern for arsenic (SA Associates 2011). The City also has a treatment plant that removes Total Dissolved Solids using reverse osmosis.

Greywater Reuse

Wastewater from showers and tubs, bathroom sinks, and washing machines are classified as greywater in California, and wastewater from kitchen sinks, dishwashers and toilets are classified as blackwater and must be disposed of through the sanitary sewer. While greywater is thought to be higher quality than blackwater, it can still pose public health and environmental risks if not reused wisely (Friedler 2004). Regulations are often complicated, and installing greywater systems can be technically challenging. As a result, public attention only drifts to greywater during extreme drought.

The current drought is no exception. Revisions to the state plumbing code in 2010 made it possible to reuse wastewater from washing machines on landscapes without a permit, as long as the water is released below at least 2" of mulch and a means of switching the flow back to the sewer is in place. Beyond that, city and county construction permits are required (2010 California Plumbing Code, Ch 16A). The City of Los Angeles has begun to make reusing greywater easier by providing "over-the-counter" permits for pre-approved systems, primarily from showers and tubs. In addition, DWP has been asked by the City Council to provide additional recommendations for promoting greywater reuse (LACity Clerk Connect Website, 2015).

Water Reclamation

In 2014, the City of Los Angeles' four wastewater treatment facilities recycled 76.2 million gallons per day (MGD) of wastewater that would otherwise have been discharged into the ocean and local rivers. While most of these facilities reclaim wastewater on their premises, the City of Los Angeles' Hyperion Treatment Plant (Hyperion) sends nearly 35 MGD of treated wastewater to the nearby Edward C. Little Recycling Facility, operated by the West Basin Municipal Water District, to be recycled. This represents an increase of 60% over the last ten years (Figure 1.1-1). The West Basin anticipates this volume to increase even more to 54 MGD in the next 2-5 years. This water is used primarily in industrial processes and for irrigation through "the purple pipes", which are colored to identify reclaimed water.

From 2013-2014, Los Angeles County's eleven wastewater treatment facilities produced approximately 155 MGD of recycled water (Figure 1.1-1). At the county level, nearly 60% of this reclaimed water is used for irrigation, industrial processes, recreational impoundments, and habitat maintenance. The rest is used for groundwater replenishment, primarily to prevent saltwater intrusion into coastal aquifers.

Not only does reclaimed wastewater supplement the water supply, but it also reduces discharges of wastewater to Santa Monica Bay, Los Angeles Harbor, and the Los Angeles River. As shown in Figure 1.1-1, the total amount of wastewater discharged by Hyperion and by the County's Joint Water Pollution Control Plant has declined by approximately 28% and 18% over the past ten years, respectively. At the same time, the amount of wastewater Hyperion has been sending to West Basin for recycling has increased 60%, which has further reduced effluent discharges from the Hyperion Treatment Plant to the ocean.

One obstacle for future expansion of reclaimed water is the state's "Service Duplication Act", or anti-paralleling statute (Pub. Util. Code § 1501-1507). It was adopted to protect the infrastructure investments made by water purveyors by discouraging one purveyor from installing competing water distribution lines in the certified service area of another purveyor. However, it can also prevent producers of reclaimed water from distributing reclaimed water unless the water purveyor in the area builds the distribution systems (purple pipes).

Desalination

Desalination has also regained attention as the drought condition worsens in the state. However, there is still on-going debate on whether desalination is a viable and cost-effective source of water supply. There is also great concern regarding the environmental impacts of ocean water intake and brine disposal. Between 2002 and 2007, the West Basin Municipal Water District conducted a demonstration project that included a 40 gallon per minute pilot facility to identify optimal performance conditions and test for water quality, and evaluate environmental impacts of ocean water intake and brine disposal methodologies. The West Basin's ultimate goal is to supplement its water-reliability portfolio with a full-scale desalination facility capable of producing at least 20 million gallons per day (MGD).

Unintended Challenges

Many of the above activities, such as water conservation measures, stormwater harvesting, and onsite infiltration may alter flows and change discharge and pollutant loading patterns in ways that have not yet been fully evaluated. These include:

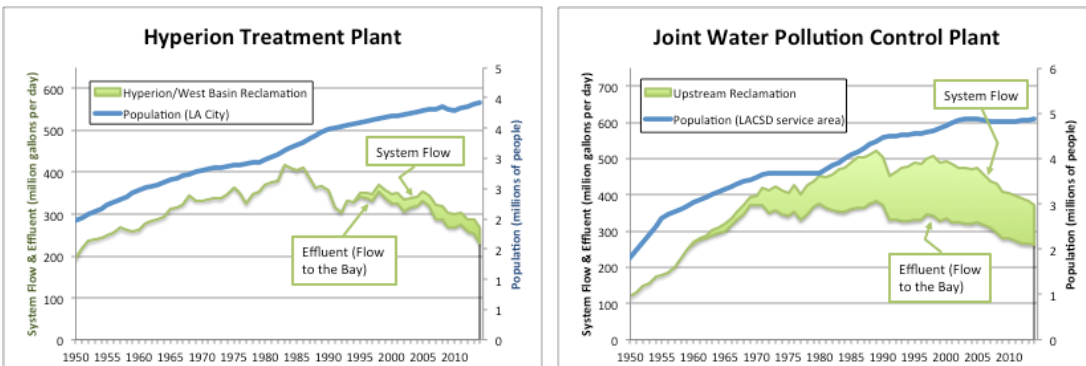
1) Increased concentrations of salts and chemicals of concern in ocean discharges (due to reduced volumes). These increased concentrations may affect behavior of the effluent plume and may have impacts on marine organisms.
2) Changes in stream flow patterns. These may affect habitat suitability for in-stream invertebrates or fish.
3) Changes in the timing and volume of freshwater discharge to coastal estuaries and lagoons. This could alter salinity patterns and mouth opening/closing dynamics.
4) Reduced pollutant loading and freshwater flows. This could aid in TMDL and NPDES compliance.

Such potential changes and their impacts should be monitored and assessed in the future.

Conclusions and Next Steps

As the state prepares to distribute Proposition 1 funds to projects that will improve water quality, supply, and infrastructure in order to alleviate the drought, consideration should be given to long-term and multi-benefit solutions. The best way forward will be to develop projects that benefit both water supply and water quality objectives through coordination across multiple agencies. LID strategies have proven effective at meeting these goals, and in many cases provide direct benefits to public health through increased green space and recreational opportunities. In many cases LID strategies incorporate native vegetation, which is drought-tolerant in southern California and provides food and structure for wildlife. Cleaning up polluted water, reducing impacts to the Bay and rivers, and securing a more diverse portfolio of water supply options are attainable through these approaches and specified in newly formed precedent-setting policies being developed and implemented throughout Los Angeles County.

Figure 1.1-1. Sanitation sewer system flows, outflows to the Bay, and population growth from 1950-2014 for the City of LA's Hyperion Treatment Plant and Los Angeles County's Joint Water Pollution Control Plant. Plant effluent discharges in both systems have been declining as a result of water conservation, recycled water use, and other factors. The volume of Hyperion's wastewater reclamation shown here does not reflect the total volume of wastewater reclaimed by the City of Los Angeles. ***(Data Sources: LA City-EMD, JWPCP, and U.S. Census Bureau)***



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