City of Los Angeles

Recycled Water Master Planning

Los Angeles Department of Water and Power
and
Department of Public Works

Executive Summary

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Contents

Executive Summary

The Los Angeles Department of Water and Power (LADWP), in partnership with the Los Angeles Department of Public Works (LADPW) Bureau of Sanitation (BOS) and Bureau of Engineering (BOE), has published a series of reports that comprise the City of Los Angeles' Recycled Water Master Planning (RWMP) documents. The RWMP documents include:

- Groundwater Replenishment Master Planning Report,
- Groundwater Replenishment Treatment Pilot Study,
- Non-Potable Reuse Master Planning Report,
- Terminal Island Water Reclamation Plant Barrier Supplement, and Non-Potable Reuse Concepts Report, and
- Long-Term Concepts Report.

Almost three years of science and engineering evaluation, pilot plant tests, market assessment, and stakeholder participation have gone into the development of the RWMP documents. This Executive Summary provides an overview of the major findings, conclusions, and recommendations of the RWMP documents.

Preparing for Los Angeles' Water Future

Since the early 1900s, the City of Los Angeles (City) has supplied water from a variety of sources. Today, the City's water comes from Owens Valley and Mono Lake Basin (Los Angeles Aqueduct); purchased water from the Metropolitan Water District of Southern California, which is imported from Northern California (California Aqueduct) and the Colorado River (Colorado River Aqueduct); and several local water sources including groundwater, stormwater capture, and recycled water. Refer to Figure ES-1 for a map of the California water system and the City's water supplies.

Future water supplies from distant sources are becoming more restricted and less reliable. Environmental commitments, periods of dry years, low snow pack, and judicial decisions have all contributed towards significant cuts in imported supplies.

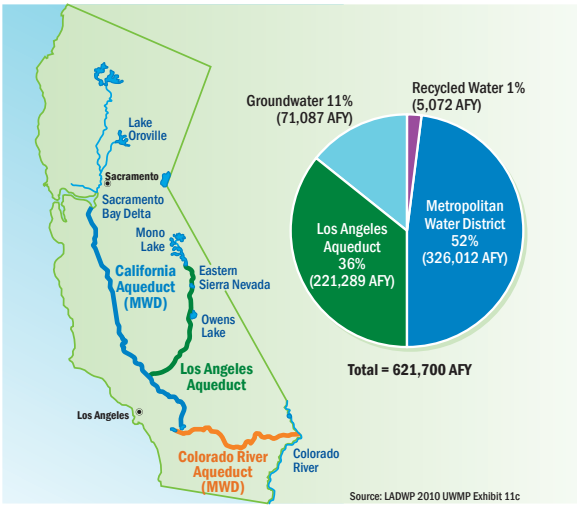


Figure ES-1: The city's water supplies (2006-2010 average) and major California water conveyance

To ensure a safe and reliable water supply for future generations of Angelenos, LADWP prepared the 2008 Securing L.A.'s Water Supply Action Plan , a blueprint for developing sustainable sources of water for the future. Increasing recycled water use was identified as

What is recycled water and how is it used?

Recycled water (also called reclaimed water) is highly treated wastewater that has gone through multiple levels of treatment that makes it safe for beneficial uses. Recycled water must be closely monitored and tested to ensure that it meets stringent health and safety standards set by the California Department of Public Health (CDPH) and enforced by nine State Regional Water Quality Control Boards (RWQCB).

Recycled water has been used for non-potable reuse applications in many parts of the United States, including Los Angeles, for decades. Municipal wastewater that has completed tertiary treatment can be used to irrigate schoolyards, parks, and residential landscape and may be suitable for industrial application such as cooling towers or for toilet flushing in office buildings. Other examples of non-potable reuse include agricultural irrigation, dust control during construction, and habitat restoration.

Recycled water for groundwater replenishment applications has a long history in the Los Angeles region. One of the most well known programs world-wide is operated by the Orange County Water District/Orange County Sanitation District. The City of Los Angeles has its own program, producing highly treated recycled water at the Terminal Island Water Reclamation Plant and injecting two to three thousand acre-feet per year of purified water into the Dominguez Gap Barrier to protect drinking water in the aquifer from seawater intrusion.

one of the City's key strategies to increase the local water supply and decrease the need to purchase imported water.

The 2008 Securing L.A.'s Water Supply Action Plan was a source document for LADWP's 2010 Urban Water Management Plan (UWMP), a multi-faceted document that is updated every five years to assess the City's water resource mix and how well it can meet anticipated demands over a 25-year planning period. The UWMP established a goal of increasing recycled water use citywide to 59,000 acre-feet / year (AFY) by 2035. Many elements go into implementation of such an important plan, including the RWMP effort that is summarized in this Executive Summary.

The RWMP documents are intended to guide near-term recycled water planning through 2035, as well as long-term recycled water planning for up to 50 years beyond the 2035 horizon. The RWMP documents include an evaluation of recycling alternatives that integrate two strategies to increase recycling: groundwater replenishment (GWR) and non-potable reuse (NPR).

Alternatives were evaluated based on a common set of planning objectives that were formed with the feedback of the Recycled Water Advisory Group, as described later, an integral part of the City's outreach efforts. Two threshold objectives had to be met, regardless of the alternative:

- **Threshold objective 1:** Meet all water quality regulations and health and safety requirements.
- **Threshold objective 2:** Provide effective communication and education on recycled water programs.

In addition, six recycled water planning objectives were used to compare alternatives against each other.

1. **Promote Cost Efficiency:** Meet the goals of the recycled water program in a cost-effective manner, considering both City and recycled water customer costs.
2. **Achieve Supply and Operational Goals:** Meet or exceed water supply targets and operational goals established by the City.
3. **Protect Environment:** Develop projects that not only protect the environment, but also provide opportunities to enhance it.
4. **Maximize Implementation:** Maximize implementation by minimizing typical hurdles including institutional complexity, permitting challenges, and maximizing customer acceptance.
5. **Promote Economic and Social Benefits:** Provide economic and social benefits in the implementation and operation of recycled water projects
6. **Maximize Adaptability and Reliability:** Maximize adaptability and reliability to be able to adapt to uncertainties and to maximize reliability of operations once projects are implemented.

The GWR and NPR strategies that best achieve planning objectives and meet the near-term recycling goal of 59,000 AFY by 2035 have an estimated capital cost of $379 - $415 million for GWR and $495 million for NPR. While these projects require significant investments, they also come with long-term benefits in developing a sustainable local resource. Recycled water is a safe, local and reliable source. For each acre-foot of recycled water delivered, an equal amount of imported water is saved. With the increasing costs of imported water, use of recycled water is projected to save the City money in the long term.

Outreach

The City has been conducting an ambitious outreach program that is closely linked with RWMP activities, milestones, and decision points. The objectives of that outreach are:

- Build trust and confidence in the City and its departments as a provider of high quality, safe, and reliable water.
- Achieve public understanding of recycled water and GWR as safe, beneficial sources of water.
- Receive stakeholder feedback on the RWMP documents.
- Be inclusive and transparent in information sharing.
- Support the media with responsive, accurate, and timely information.

Outreach activities led by the City during the development of the RWMP have included: presenting to and receiving feedback from the Recycled Water Advisory Group (RWAG): briefings for City Council and other elected officials; one-on-one briefings with key stakeholders; presentations to Neighborhood Councils, community organizations, non-government organizations (NGOs), and business groups; conducting Recycled Water Forums throughout the City; holding Urban Water Management Plan Workshops; informing LADWP/BOS employees; gathering written support; and maintaining a stakeholder database.

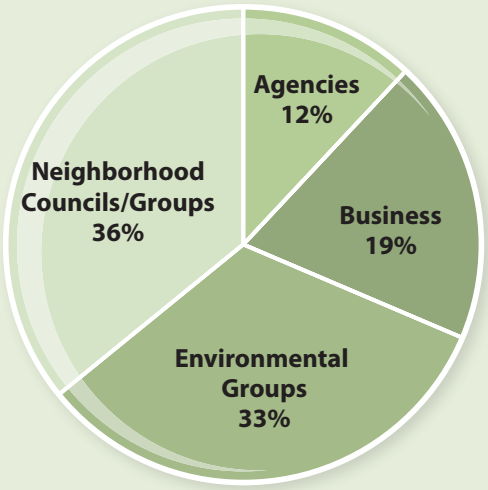


Figure ES-2: RWAG participants represent diverse interests

RWAG, a group of approximately 60 key stakeholders, was formed to provide input and ideas related to increasing the amount of recycled water beneficially used in Los Angeles. The group has attended a series of half-day workshops, facility tours, and update sessions; listened to concepts and studies integral to the RWMP process; and provided insightful feedback. RWAG participants reflect a wide diversity of interests and are well informed about recycled water and related issues. Figure ES-2 shows participation in the RWAG by category of interests.

In addition, LADWP worked with the National Water Research Institute to establish an Independent Advisory Panel (IAP) since 2010. This panel of leading experts is providing independent, credible, third-party scientific and technical review of the City's recycled water master planning efforts. The IAP for the GWR project includes experts in engineering, chemistry, microbiology, toxicology, soil chemistry, operations, regulatory criteria and public health, public outreach, water utilities, and economics/social sciences. Seeking the input of the scientific community, early in the process, allows the City to proactively discuss alternatives with regulatory agencies to ensure a successful GWR project.

LA's Current and Planned Recycled Water Supply

In Los Angeles, recycled water is currently produced at three water reclamation facilities owned by the City and operated by the BOS:

- Donald C. Tillman Water Reclamation Plant (DCTWRP)
- Los Angeles-Glendale Water Reclamation Plant (LAGWRP), and
- Terminal Island Water Reclamation Plant (TIWRP)

Secondary treated water is produced at the City's Hyperion Treatment Plant (HTP) and is provided to West Basin Municipal Water District (WBMWD) for further treatment. The City uses tertiary treated water from WBMWD for beneficial reuse.

LADWP's recycled water service area is grouped into four main service areas: Harbor, Metro, Valley and the Westside.

The existing distribution system has 45 miles of pipeline, two water tanks, and three pumping stations. Existing recycled water infrastructure offsets approximately 8,000 AFY of potable water.

LADWP is currently planning, designing, or constructing expansions of recycled water infrastructure that will deliver an additional 11,350 AFY. Together, this infrastructure – in place or in progress – will provide 19,350 AFY of recycled water for beneficial uses. Figure ES-4 shows existing and planned recycled water systems.

Definitions Used in Master Planning

Existing:
Recycled water facilities and customers as of January 2012.

Planned:
Recycling projects that are either in a stage of final planning, design, or construction as of January 2012.

Potential:
Recycling projects that have the potential to help achieve future recycling goals for the 2035 planning horizon.

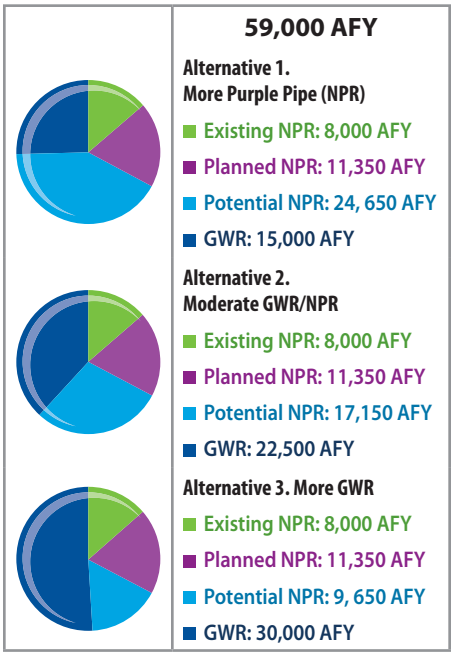


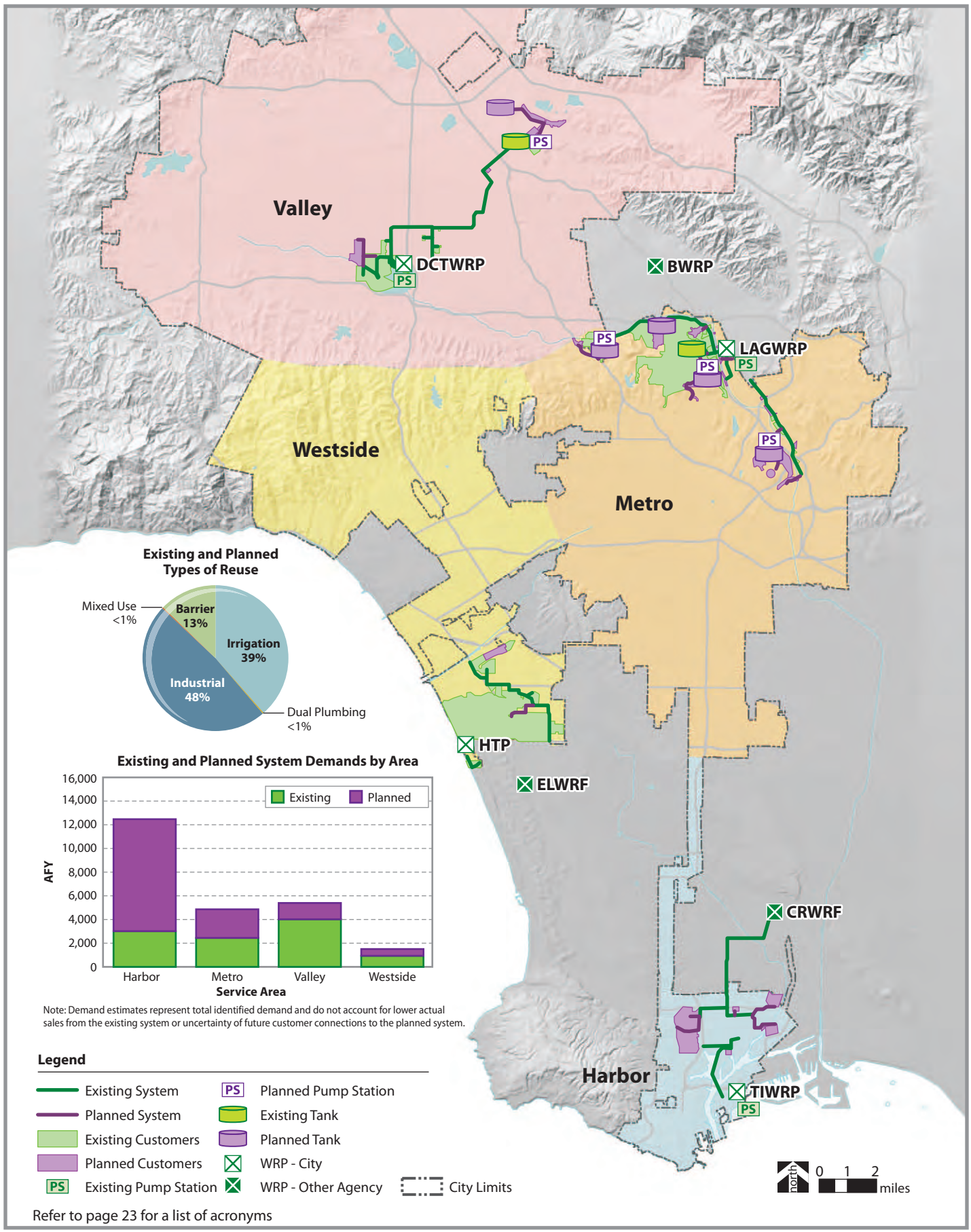
Figure ES-3: Integrated Alternatives to achieve Recycled Water Goals

Meeting the Goal of 59,000 AFY

LADWP's current systems and planned NPR projects will deliver 19,350 AFY of the 59,000 AFY goal. The RWMP focus for the near-term was to determine the best way to deliver the remaining 39,650 AFY of recycled water by 2035. Integrated alternatives to achieve 39,650 AFY were developed around three themes, as shown in Figure ES-3.

The integrated alternatives were evaluated against the recycled water planning objectives to determine what combination of GWR and NPR projects would best meet the City's recycled water goals. Of the three alternatives shown to the left, Alternative 3 – More GWR – was determined to be most beneficial for Los Angeles since it performs better than alternatives with less GWR in terms of capital costs and project implementation. The integrated alternatives analysis established the basis for subsequent recycled water master planning.

The GWR and NPR Master Planning reports described in the following sections were based upon achieving 30,000 AFY of recycled water use through groundwater replenishment and 9,650 AFY through new non-potable reuse projects by 2035. While these are the goals for GWR and NPR at this time, the actual amounts implemented in the future are flexible in meeting the City's overarching goal of 59,000 AFY of recycled water by 2035 to offset imported water purchases. The RWMP documents are intended to serve as a guide for future management decisions and provide information regarding the trade-offs of adjusting the mix of NPR and GWR as the recycled water program develops in the future.



Refer to page 23 for a list of acronyms

Figure ES-4: Existing and Planned Recycled Water Systems


DCTWRP Japanese Garden


Sepulveda Basin Wildlife Reserve


Los Angeles River

Groundwater Replenishment

The preferred recycled water alternative from the integrated alternatives analysis includes providing up to 30,000 AFY of recycled water for GWR by 2035. At this time, it is envisioned to be implemented in two phases (see Table ES-1). The GWR project schedule will be closely linked with the timing of the San Fernando Basin Groundwater Treatment Complex (discussed further in the Implementation Section).

Table ES-1: GWR Projects Implementation Schedule

GWR Project Phases	Imported Water Offset	Target Year
GWR Project – Phase 1	15,000 AFY	In service by 2022
GWR Project – Phase 2	Up to 30,000 AFY	In service by 2035

Figure ES-5 illustrates established GWR processes that begins with treating recycled water at an advanced water purification facility (AWPF), conveying the water to spreading grounds, and allowing that water to percolate into natural underground aquifers to replenish the groundwater basin. It will take at least two years for water released into spreading basins to reach the well field for extraction.

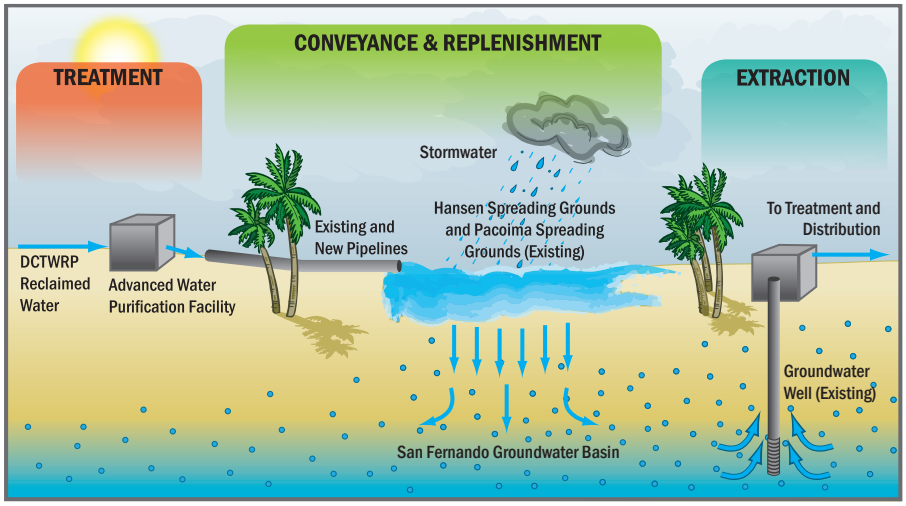


Figure ES-5: GWR Concept

The GWR Master Planning Report is one element of the RWMP documents. The report developed and analyzed GWR options with respect to the science, technology, regulatory, and cost arenas to support the pursuit of using purified recycled water to replenish Los Angeles' groundwater basins – a significant, local source of the City's drinking water supply. GWR focuses on leveraging existing City assets: 1) water rights and existing facilities to add and extract water from the San Fernando Basin; and 2) ownership and operation of the nearby DCTWRP, which has a maximum design flow capacity of 80 million gallons per day (mgd).

A key planning parameter for GWR was the amount of water available that could be treated in the AWPF. The amount of incoming wastewater (influent) to DCTWRP and other demands for recycled water was considered. Assuming that all available flows in the wastewater collection system are routed to DCTWRP (and not to other water reclamation plants), DCTWRP is expected to meet existing and planned NPR demands, both phases of GWR, as well as other current uses. These uses include approximately 2 mgd for in-plant reuse and up to 27 mgd for Lake Balboa, Wildlife Lake, the Japanese Gardens, and the Los Angeles River.

Table ES-2 summarizes AWPF production capacity and annual NPR and GWR recycling for Phase 1 and Phase 2. Assumptions for the AWPF sizing include the following:

- All recycled water for both GWR and NPR is treated at the AWPF. While this assumption was made for conservative AWPF sizing, it is likely that some NPR customers will continue to use Title 22 recycled water.
- Purified water is recharged through existing surface spreading grounds, which have limited availability in extreme wet years due to substantial stormwater recharge

Table ES-2: GWR Flow Summary

Parameter	Phase 1 Capacity	Phase 1 and 2 Capacity
AWPF Product Water Capacity	**25 mgd**	**35 mgd**
AWPF Annual Production Potential		
▪ Non-potable Reuse	5,000 AFY	5,000 AFY
▪ Groundwater Replenishment	15,000 AFY	30,000 AFY
Total	**20,000 AFY**	**35,000 AFY**

Note: Existing spreading grounds may be unavailable for replenishment of the AWPF product water during extreme wet weather conditions when stormwater takes precedence over purified recycled water. To achieve the full 30,000 AFY of GWR in wet years for Phase 2, additional recharge facilities (such as injection wells) may be needed.

While purified recycled water can be delivered to spreading grounds at a relatively steady rate throughout the year, stormwater fluctuates seasonally and annually. Therefore, the spreading grounds may be unavailable for recharge of the AWPF product water during extreme wet weather conditions when stormwater takes precedence over purified recycled water.

Advanced Water Purification Facility

Figure ES-6 shows the major treatment processes that exist for DCTWRP (through tertiary treatment) and that are proposed for the AWPF, which could be sourced with secondary or tertiary water as demonstrated in pilot testing (discussed later). A series of advanced treatment processes, including membrane filtration, reverse osmosis, and an advanced oxidation process (AOP) that includes ultraviolet light and hydrogen peroxide, would be added to DCTWRP reclaimed water to produce purified recycled water that replenishes the City's groundwater resources and supplements potable water supplies. An alternative AOP process using ozone and hydrogen peroxide has been pilot tested and could be used as a substitute.

Preliminary/primary treatment removes up to 85 percent of solids that are screened out, settle to the bottom or float to the top of tanks. Secondary treatment removes organics and suspended solids, using beneficial microbes that feed on them. Tertiary treatment removes remaining solids with filtration and disinfects with chlorine to kill bacteria, viruses and other micro-organisms. Advanced purification removes additional organics, micro-organisms and salts.

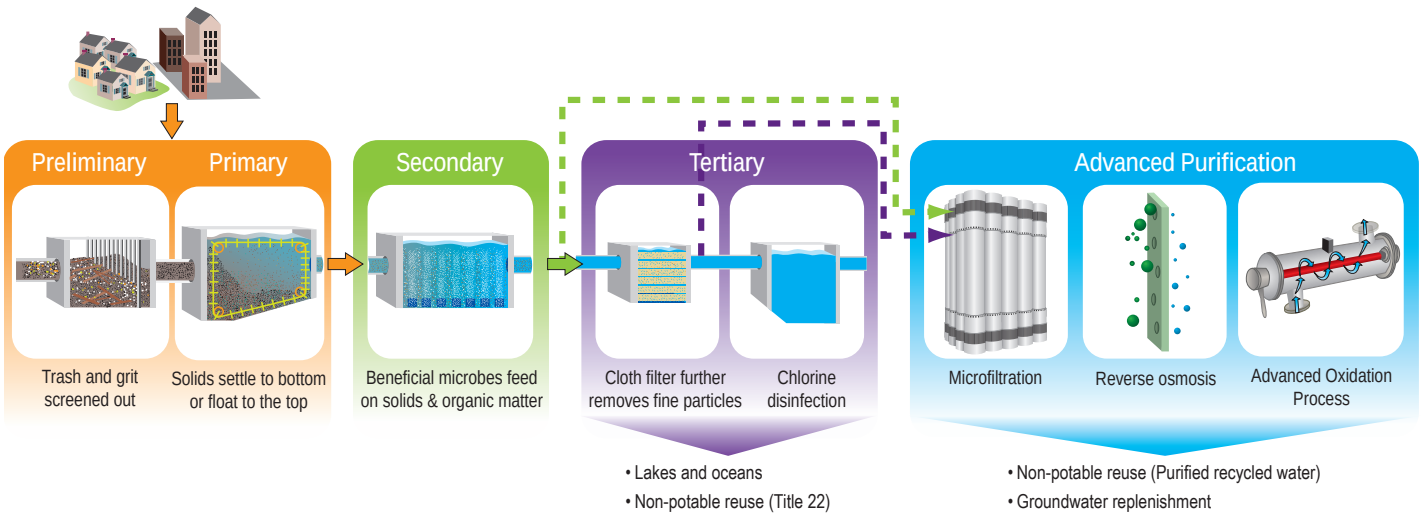


Figure ES-6: DCTWRP and AWPF Treatment Process

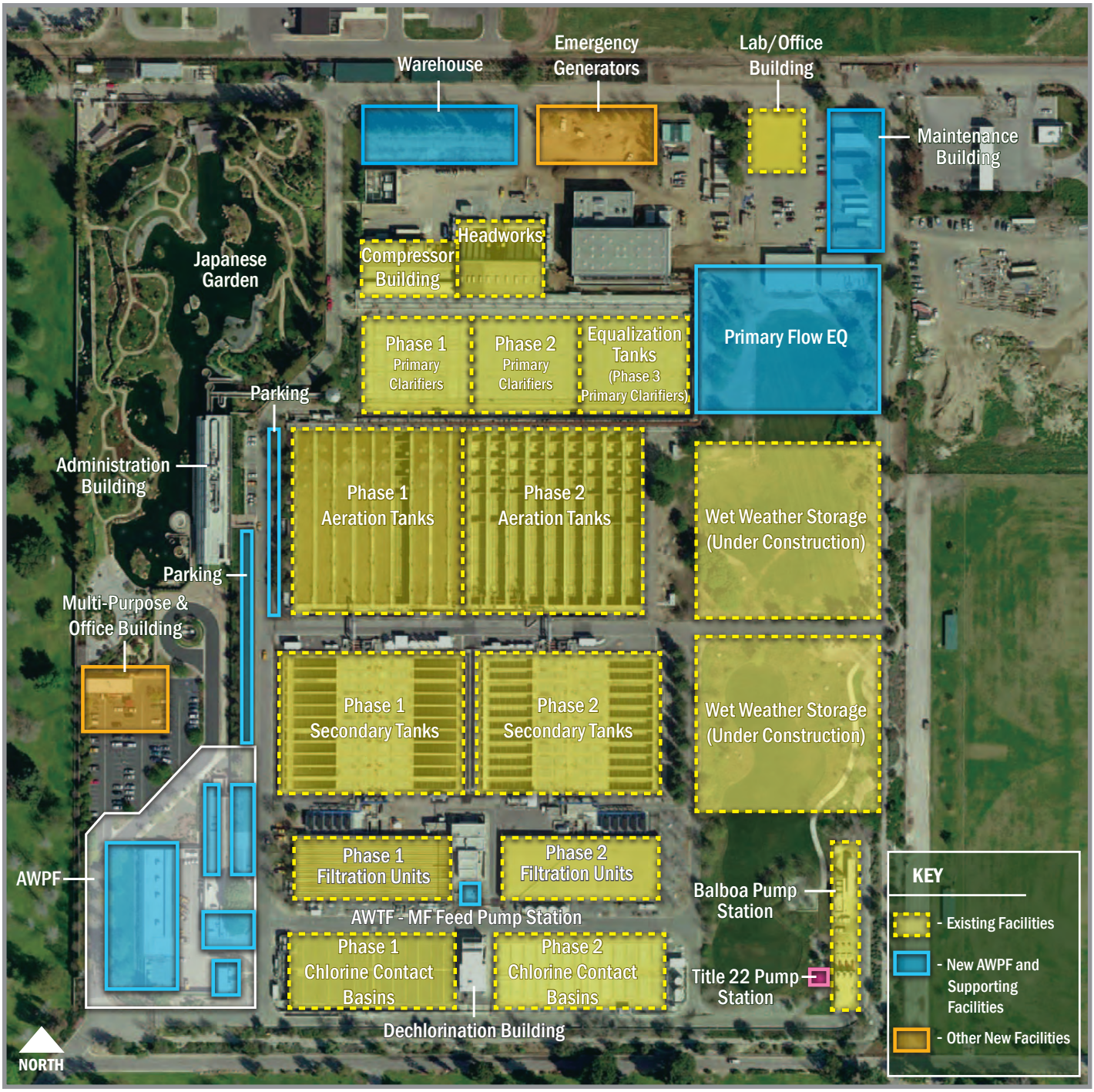


Figure ES-7: Aerial View of DCTWRP Preliminary Site Plan

Five viable sites were identified as candidate locations for the AWPF at the City's DCTWRP and Valley Generating Station (VGS). Although all five sites will be carried forward for environmental documentation, the City's preferred site location for the AWPF is located at the southwest corner of the existing DCTWRP based on analysis of proximity to existing facilities and staff for economics of operation, proximity to flood control facilities, and location of other future treatment process expansion opportunities. Figure ES-7 shows an aerial view of the DCTWRP with proposed AWPF improvements shown in blue.


Donald C. Tillman Water Reclamation Plant

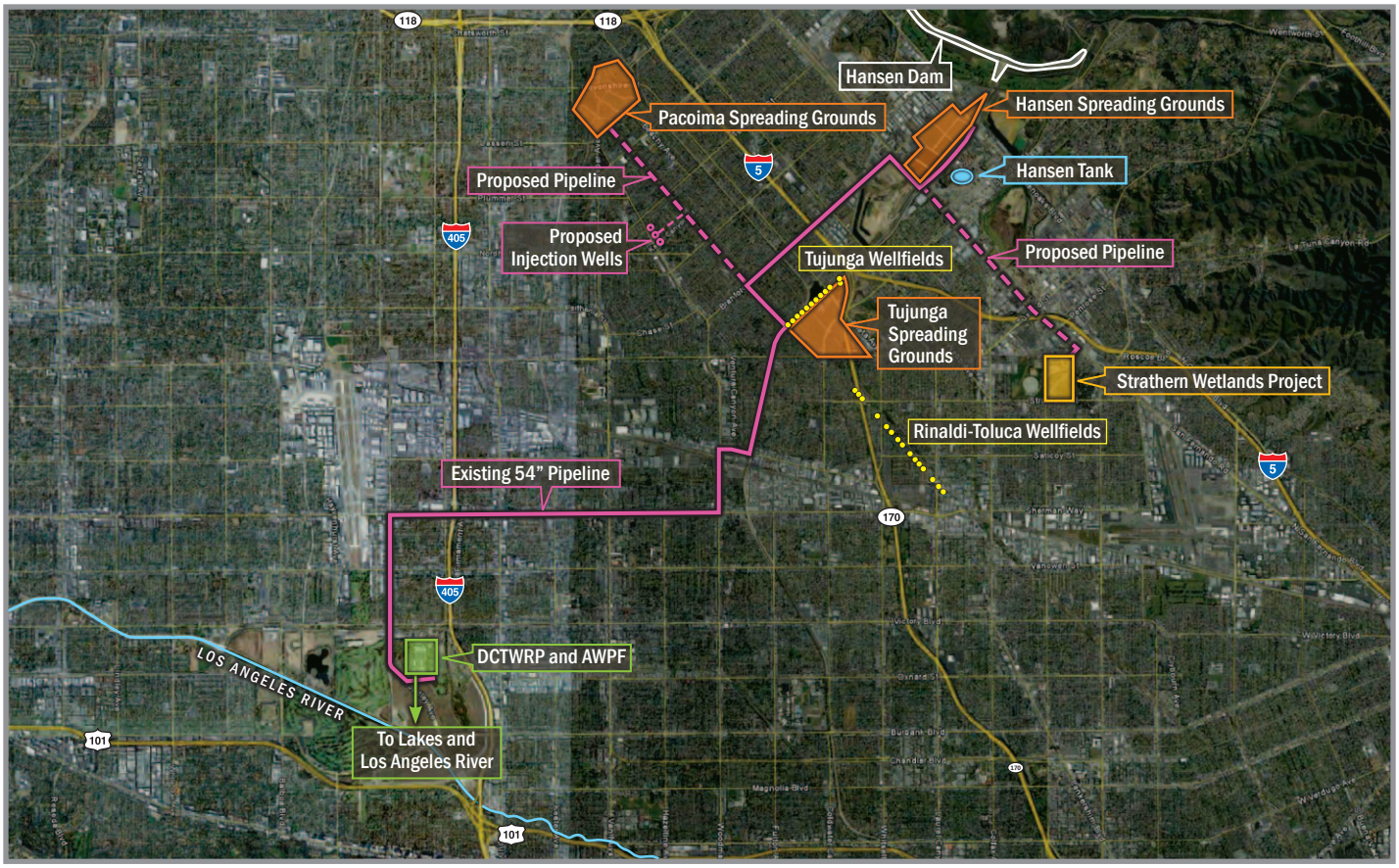


Figure ES-8: Facilities Vicinity Map

Conveyance and Replenishment Facilities

After the water is treated in the AWPF, it will be conveyed by an existing pipeline to existing spreading grounds to replenish the San Fernando Basin. Ultimately it will be extracted using existing wells and provide a safe, reliable, local supply of water.

For Phase 1, all of the water can be replenished through surface spreading at the Hansen Spreading Grounds (HSG). For additional replenishment in Phase 2, both the HSG and Pacoima Spreading Grounds (PSG) would be used. However, two options were considered since existing spreading capacity may not be adequate for replenishment of up to 30,000 AFY during extreme wet years. Two options are considered for Phase 2:

- **Phase 2 Option A:** assumes surface spreading at both the HSG and PSG
- **Phase 2 Option B:** assumes surface spreading at both the HSG and PSG, plus recharge through potential injection wells and/or surface spreading at the Strathern Wetlands Project

The HSG and PSG are shown in Figure ES-8. Purified recycled water will be conveyed from DCTWRP to HSG through the existing 54-inch pipeline during Phase 1. A new pipeline will be constructed to connect the 54-inch pipeline with PSG for both Phase 2 Options A and B. For Option B, the injection wells will be located along this new pipeline route.


Hansen Spreading Grounds


Pacoima Spreading Grounds

Estimated Costs

GWR project costs were evaluated for all options for the costs to design and build the project facilities (capital costs) and the costs to operate and maintain the facilities (O&M costs). Capital costs include improvements for the AWPF and spreading grounds, and O&M costs include power, chemicals, labor, and equipment replacement for the AWPF. Table ES-3 summarizes the conceptual level opinion of probable costs.

Table ES-3: Conceptual-Level Costs for All GWR Project Components

Component	Costs	
	Capital Costs[1,2]	Annual O&M Costs
Phase 1	$285 M	$9.26 M
Phase 1 and 2		
▪ Without Injection Wells	$379 M	$17.0 M
▪ With Injection Wells	$415 M	$17.9 M

Notes:

1. All costs are in 2011 dollars

2. Includes 30% contingency and 30% implementation costs

In order to evaluate cost-effectiveness of recycled water projects, the costs need to be compared against the status quo. Recycled water is a local supply that would offset the need to purchase imported water that originates from Northern California and the Colorado River. With expected increasing costs of imported water, today's investments are estimated to be more cost-effective in the future. Refer to the Financing Options section for a comparison of projected imported water costs and recycled water project costs.

Regulatory and Permitting Considerations

The use of recycled water for groundwater recharge is carefully regulated under several state laws and regulations to ensure protection of public health and water quality. The CDPH and RWQCB have regulatory oversight of groundwater recharge projects in the Los Angeles basin. In addition, the project must comply with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). NEPA is required since the proposed project is located on federal land (DCTWRP is located on land owned by the United States Army Corps of Engineers). NEPA will also be required if federal funding for the project becomes available. Planning and permitting activities include public outreach; the IAP; regulatory coordination with CDPH, Los Angeles RWQCB, and the State Water Resources Control Board (SWRCB), and others; and environmental documentation. As part of the RWMP process, a permitting strategy has been outlined that clearly defines the path forward for obtaining regulatory approval to implement a GWR project.

The primary drivers for the City's planning decision to utilize advanced treatment of recycled water are related to regulatory requirements for blending, which affects the desired recharge goal of 30,000 AFY. Under the CDPH 2008 draft groundwater recharge regulations, it is expected that initially, at least 50 percent of the water that replenishes the groundwater basin will need to come from non-recycled water sources, such as imported water or stormwater. Blending requirements depend on the level of treatment applied to recycled water. Projects that use advanced treatment of recycled water can, over time, have the amount of blending water reduced to zero. Because the amount of stormwater available for blending is limited, replenishing with advanced treated water provides a benefit in helping to preserve limited imported water resources, and allows the City to achieve 30,000 AFY of GWR.

As of 2012, CDPH GWR regulations are being revised, and this may afford LADWP an opportunity to pursue potential alternatives to the current GWR concept. The GWR concept that has been thoroughly analyzed and evaluated in the RWMP documents represents the most conservative path from a financial perspective. Any alternative option will require further analysis and can only be considered if it offers public health protection as well as compliance with changing regulations. Stakeholder input would also be sought during such analysis. The City's commitment is first and foremost to public health protection along with implementing a cost effective project.

Groundwater Replenishment Pilot Testing

A critically important part of the GWR master planning process was to operate a pilot project consisting of different purification technologies using the actual treated wastewater from DCTWRP. The pilot study was beneficial not only in analyzing different technologies, but also as an outreach platform. The purpose of the pilot project was to test alternative source waters available at DCTWRP and evaluate the effectiveness of advanced water purification (AWP) technologies on those specific waters.

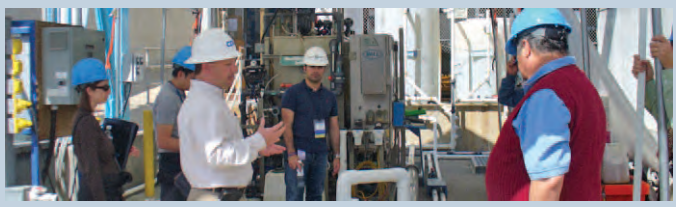
The pilot study tested the following AWP technologies that are proposed for the AWPF:

- Microfiltration (MF)
- Reverse osmosis (RO)
- Advanced oxidation process (AOP) using ultraviolet (UV) light and hydrogen peroxide (H_2O_2)
- An alternative AOP using ozone and H_2O_2

The primary function of the MF system is to provide pretreatment for sustainable operation of the RO process. The MF also provides the first barrier against protozoa and bacteria, which should be undetectable in the MF product. The primary function of the RO process is to provide removal of dissolved salts and organic contaminants. The primary function of the AOP system is to destroy trace organic compounds not completely removed by the RO membranes. Each of these processes have been successfully permitted by the CDPH and RWQCB for other GWR programs run by nearby agencies, such as the Orange County Water District's Groundwater Replenishment System.

Pilot testing was conducted over 16 months in three phases:

- Phase 1 validated the proposed processes used at existing advanced water purification facilities in California, including MF, RO, and UV/H_2O_2 – considered the baseline treatment process.
- Phase 2 evaluated ozone/H_2O_2 as an alternative to UV/H_2O_2, pilot tested side-by-side and with target contaminants spiked into the test water supply.
- Phase 3 confirmed the recommended operating conditions from Phases 1 and 2 and also evaluated two alternative RO membranes.



Stakeholders tour the pilot plant project

Membrane filters installation

Source Water Evaluation: Design for Flexibility

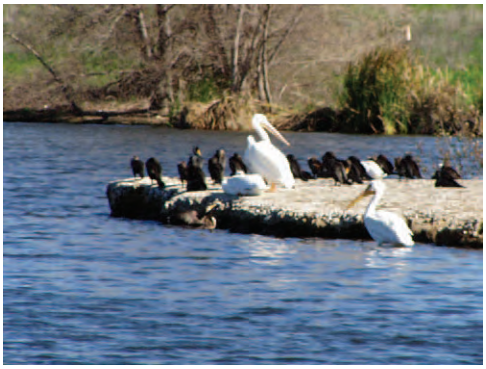
Pilot testing results demonstrated that there were no significant differences in operating efficiency or water quality when secondary or tertiary effluents were used as feed water to the AWPF. It was recommended that the full-scale facility be designed to allow flexibility to use either secondary or tertiary effluent as source water, taken before chlorine addition.

Water Quality

Water quality results from the pilot testing confirmed that all existing and draft drinking water and recycled water regulations can successfully be met using the proposed treatment processes. More than 300 different regulated and unregulated compounds were measured over the course of pilot testing with all measuring well below their regulated limits and, in most cases, below detectable levels in the final product water.

Seventy-two different pharmaceuticals, personal care products, and endocrine disrupting compounds were tested to confirm their removal by the treatment process. These compounds were removed by both the RO process and the advanced oxidation, with concentrations in the final product water below detectable levels for all but three compounds, which were measured at concentrations that averaged 5 nanograms per liter or less, the equivalent of one teaspoon split between 400 Olympic-size pools. New technologies allow us to measure these compounds at extremely low concentrations. These minute concentrations are lower than those in existing surface water supplies which satisfy public health requirements.

Testing results demonstrated that the proposed AWP processes provide exceptional water quality that is safe for GWR.



Non-Potable Reuse

In addition to 30,000 AFY of groundwater replenishment, the preferred alternative from the integrated alternatives analysis includes providing an additional 9,650 AFY of NPR by 2035, over and above the 11,350 of planned projects already in the planning, design or construction phase. Non-potable reuse is the use of recycled water for a beneficial purpose and requires a source of supply, a dedicated recycled water pipeline to distribute the water, and a customer demand for the water. For decades, recycled water has been successfully applied in place of potable water for a range of uses, including:

- Landscape irrigation
- Agricultural irrigation
- Industrial process water
- Power plant cooling water
- Toilet flushing
- Car washing
- Dust control during construction
- Commercial cleaning
- Habitat restoration

The State of California regulates the treatment, use, and discharge of recycled water according to Title 22 of the California Administrative Code. The state Water Recycling Criteria are developed by the CDPH and enforced by the RWQCB. In Los Angeles, the water reclamation process for NPR includes primary treatment, secondary treatment, and tertiary treatment as described earlier in Figure ES-6. In limited situations where the quality of recycled water does not meet non-regulatory criteria for use in specialized industrial or other processes, additional treatment may be required, such as MF and RO.

The Non-Potable Reuse Master Planning Report is one element of the RWMP documents, in which approximately 40 potential NPR projects were identified. These projects, when taken together, exceed the reuse goal of 9,650 AFY and will serve as a "menu" of potential projects across the city that can be implemented incrementally as funding becomes available.

Key planning parameters for the NPR evaluation included the potential market for non-potable water (locations of potential customers and the size of their demands), the potential supply of recycled water from City water reclamation plants as well as from other plants in the region, and the conveyance facilities requirements required to distribute the water.

LADWP's recycled water systems are located in four service areas: Harbor, Metro, Valley, and Westside. The NPR Master Planning Report recommended new water recycling projects for all four service areas based upon analyses of the most likely target customers, how much water they might use, and which recycled water systems could best meet the demands.

Market Assessment

The market assessment identified approximately 110 potential target customers located throughout the city that have non-potable demands (for irrigation and other mixed uses) greater than 50 AFY. These 110 potential target customers comprise just 3 percent of LADWP's total customer accounts, but represent 36 percent of the total demand for recycled water.

Of the four service areas, the Valley has the most target customers and potential non-potable demand, predominantly for irrigation. Analyses showed that more than 50 percent of the City's total potential irrigation demand comes from Valley target customers.

Since irrigation demands fluctuate seasonally (with higher demands during dry, hot summer months), it is important to assess whether supply capacity is sufficient to serve the NPR potential market, over and above customers of the existing and planned NPR system.

Supply Assessment

LADWP's potential NPR target customers could be supplied from several recycled water sources including increased deliveries from existing WRPs, new satellite treatment plants within the City's service area, or purchased recycled water from neighboring agencies. Existing recycled water supplies considered in the supply assessment include three WRPs owned by the City and two WRPs owned by WBMWD:

- City's Los Angeles-Glendale Water Reclamation Plant (LAGWRP) for the Metro-LAGWRP System.
- City's DCTWRP for the Valley-DCTWRP System.
- City's TIWRP for the Harbor-TIWRP System.
- WBMWD's Carson Regional Water Reclamation Facility (CRWRF) for the Harbor-WBMWD System.
- WBMWD's E.C. Little Water Recycling Facility (ELWRF), which receives secondary effluent from the HTP, for the Westside System.

Potential new recycled water supplies include:

- Purchasing recycled water from adjacent agencies: WBMWD, Burbank Water and Power (BWP), Central Basin MWD (CBMWD), and Las Virgenes MWD (LVMWD);
- New satellite treatment facilities: two in the Metro, one in the Valley, and one in the Westside service areas.

Some of the sources for potential NPR projects have competing future uses such as GWR or use by other agencies. For example, DCTWRP does not have enough supply to implement both GWR and all potential NPR projects in the Valley. This will need to be considered as the recycled water program develops in the future.

DCTWRP Administration Building

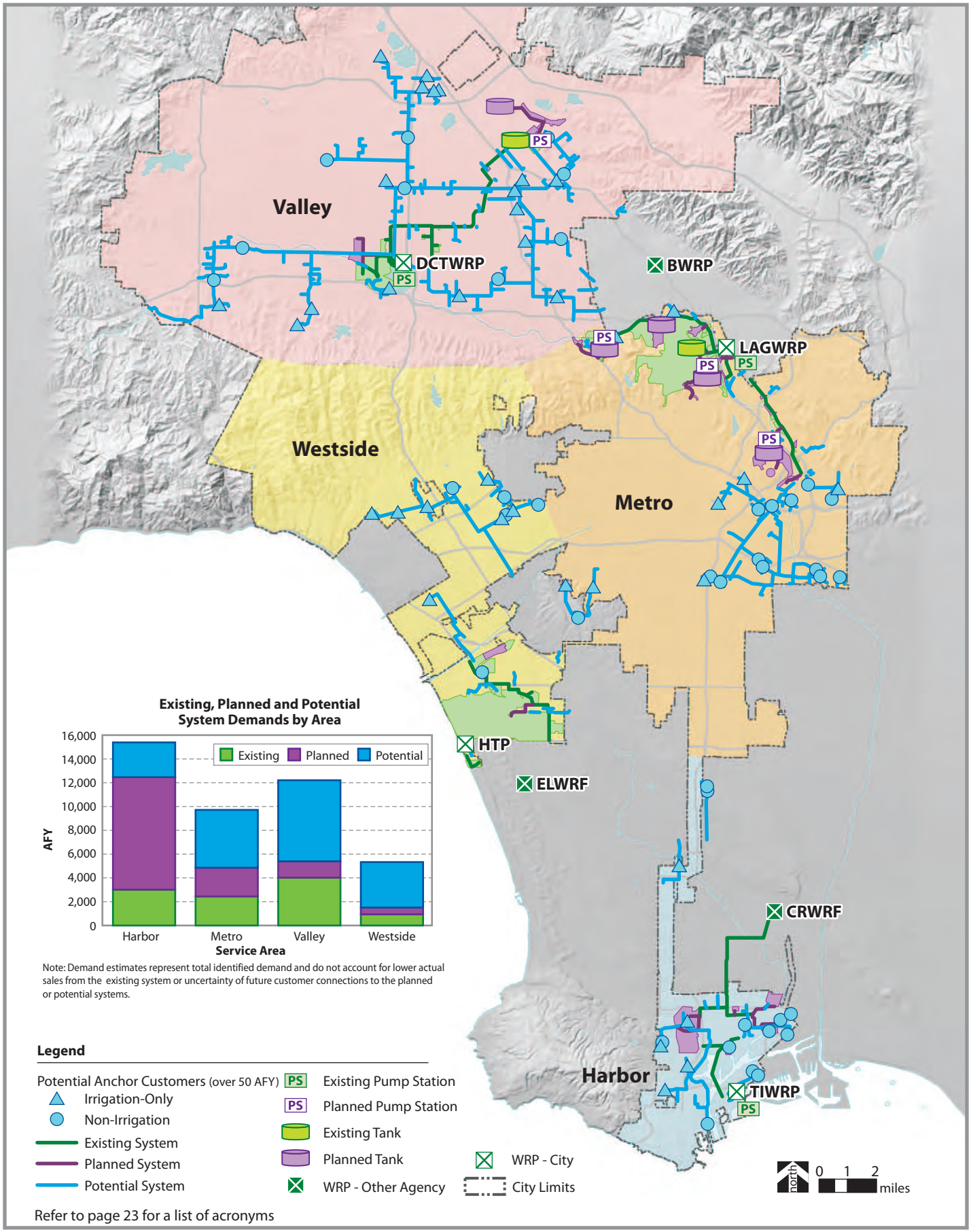


Figure ES-9: Potential NPR Recycled Water Systems

Potential NPR Systems and Estimated Costs

Once the potential NPR demands and supplies were characterized, approximately 40 potential projects were developed through analysis of distribution facility improvements (pipelines, pump stations, and storage tanks). The projects were further grouped into 11 potential NPR systems within the four recycled water service areas, and system demands were adjusted to include nearby potential customers with smaller demands. Figure ES-9 illustrates the potential NPR system demands by LADWP service area, and Table ES-4 presents estimated planning level costs for customers with demands greater than 5 AFY.

Table ES-4: Summary of Potential Systems

Service Area	System	Demand Estimates[1] (AFY)	Cost for Potential Systems	
			Capital Cost ($M)	Operations and Maintenance Cost ($M/yr)
Harbor:	TIWRP	2,131	$30.3	$3.00
	WBMWD	1,199	$4.9	$0.97
	Gateway	646	$6.2	$0.48
Metro:	LAGWRP	3,465	$35.6	$0.32
	CBMWD	3,778	$66.1	$2.19
Valley:	DCTWRP AWPF	736	$15.5	$0.13
	DCTWRP T22	3,502	$108.4	$0.92
	Burbank	1,807	$53.7	$0.48
	Las Virgenes	954	$23.7	$0.51
Westside:	Westside	570	$13.3	$0.44
	Westwood	3,185	$76.0	$2.99
Total, Projected Potential		**9,650***	**$195.1**	**$4.50**

[1] *Demand estimates are for customers with a demand greater than 5 AFY*

The combined total potential recycled water demand for all projects in the 11 systems exceeds the 2035 goal of 9,650 AFY. However, there is uncertainty as to whether all the potential demands would be realized in the future. Connection to the recycled water system is voluntary and requires customer participation for successful implementation. It is anticipated that not all customers will connect due to site constraints, cost limitations, or other unknown factors that cannot be predicted.

Going forward, the identified NPR projects will serve as a "menu" for the city to implement the most viable and cost-effective projects, with commitment from potential customers, in achieving 9,650 AFY or more of additional NPR by 2035.

Total prospective costs for existing, planned, and potential NPR systems is shown in Table ES 5. Prospective costs are costs that could be avoided if other actions are taken and do not include any "sunk" costs such as existing program administration costs or capital payments. In order to evaluate cost-effectiveness of recycled water projects, the prospective costs need to be compared against existing imported water supplies. Recycled water is a local supply that would offset the need to purchase imported water that originates from Northern California and the Colorado River. With expected increasing costs of imported water, today's investments would be more cost-effective in the long term. Refer to the Financing Options section for a comparison of projected imported water costs and recycled water project costs.

Table ES-5: Total Prospective Costs for Existing, Planned and Potential NPR Systems

	Demand Estimates (AFY)	Capital Cost ($M)	Operations and Maintenance Cost ($M/year)
Existing NPR	8,000	- -[1]	$7.3
Planned NPR	11,350	$300	$10.6
Potential NPR	9,650	$195	$4.5
Total	**29,000**	**$495**	**$22.4**

[1] *Capital expenditures for work prior to July 2011 ($235 million) are considered "sunk" and are not included.*

Regulatory and Permitting Considerations

Recycled water for non-potable reuse is carefully regulated but is considered a traditional application of recycled water and has a relatively straightforward permitting process. The State of California regulates the treatment, use, and discharge of recycled water according to Title 22 of the California Administrative Code. The state Water Recycling Criteria are developed by the CDPH and enforced by the RWQCB.

A future regulatory consideration applicable to non-potable reuse is the requirement for the preparation of Salt and Nutrient Management Plans by 2014 under the SWRCB Recycled Water policy. LADWP is addressing these requirements for the San Fernando Groundwater Basin. In addition, LADWP is participating in the development process for the plans of the Central Basin and West Coast Basin, which are being led by the Water Replenishment District of Southern California. No significant requirements are expected to be generated through these plans that would impact LADWPs recycled water program, and implementation of an NPR project is not expected to face significant permitting challenges in the future.

Barrier Supplement

Based on the integrated alternatives analysis, the preferred way to achieve the City's water supply goals of 59,000 AFY recycled water use by 2035 is through 30,000 AFY of GWR and 9,650 AFY of NPR (in addition to the 19,350 AFY of existing and planned NPR). However, water recycling helps to achieve not only the City's water supply goals but also wastewater management goals. Wastewater management goals to reduce treated effluent discharges to the Los Angeles Harbor may drive the need for additional reuse from the TIWRP, which is located adjacent to the harbor. Potential NPR projects have been identified that increase recycling from TIWRP. Another option that would help increase recycling from TIWRP could be to expand infrastructure to the Dominguez Gap Barrier (Barrier).

The Barrier is a 4.3-mile long seawater intrusion barrier near the coast between the Los Angeles Harbor and the Long Beach Harbor. The Barrier is created by injecting a blend of imported and purified recycled water into the ground to prevent the movement of seawater in to the West Coast Basin, a valuable groundwater resource and existing supply for the region. Currently, water for the barrier comes from two sources: potable water imported to the region by the Metropolitan Water District of Southern California and advanced treated (purified) recycled water supplied by TIWRP.

AWPF at TIWRP producing highly purified water

The Barrier is the largest end user for TIWRP, using over 99 percent of the purified recycled water produced there. The quantities of recycled water delivered could eventually increase to serve the Barrier demands with a 100 percent recycled water contribution (no blending with imported water). In order to achieve this, improvements to the treatment facilities at TIWRP as well as conveyance infrastructure would be needed.

Table ES-6 describes a phasing plan and provides a list of required major facilities for each phase of expansion of the AWPF at TIWRP in order to achieve expanded recycled water delivery to the Barrier, irrigation, or other potential uses.

Currently, Los Angeles County Department of Public Works (LACDPW) is conducting a condition assessment of the Barrier that will evaluate conveyance and operational options. The condition assessment will allow a more thorough evaluation of alternative solutions for increasing recycled water use at the Barrier.

Table ES-6: TIWRP Phase Expansion Strategy

Phase	Objective	Improvements	Capital Costs
Phase I	▪ Restore reliable production of existing facility to 5 mgd. ▪ Increase recycled water deliveries to the Barrier.	▪ Replace MF and RO membranes. ▪ Install two additional MF skids. ▪ Modify the stabilization system. ▪ Other miscellaneous mechanical and electrical improvements.	$5.4M
Phase II	▪ Increase production of AWPF to 6 mgd. ▪ Expand recycled water contribution (RWC) at the Barrier to over 50%. ▪ Potentially meet Harbor irrigation demands	▪ Add two additional MF skids. ▪ Install a new concentrate valve. ▪ Other mechanical improvements and flow testing to maximize the production of the existing RO trains. ▪ Install UV disinfection and advanced oxidization process system.	$5.4M
Phase III	▪ Increase production of AWPF to 9 mgd. ▪ Meet 100% of anticipated Barrier demand. ▪ Potentially meet Harbor irrigation demands.	▪ Add new MF and RO trains. ▪ Expand stabilization system and UV disinfection.	$30.0M
Phase IV	▪ Increase production of AWPF to 12.5 mgd. ▪ Meet 100% of anticipated Barrier demand). ▪ Potentially meet maximum anticipated Harbor irrigation demands. ▪ Meet other demands including non-irrigation users and interagency transfer.	▪ Add new MF and RO trains. ▪ Expand stabilization system and UV disinfection.	$33.7M

Long-Term Concepts: Beyond the 2035 Planning Horizon

Like other major utility infrastructure, recycled water projects take years of research, study, and planning before they are actually constructed. To plan for future generations, LADWP has taken a pro-active step in identifying potential long-term concepts that could be implemented beyond the 2035 planning horizon. Supply from long-term concepts would be over and above the City's goal of 59,000 AFY recycling for 2035. The Long-Term Concepts Report, one element of the RWMP documents, identifies potential project concepts that could maximize the beneficial reuse of recycled water produced at the City's existing treatment plants, a potential new satellite plant, and/or at plants operated by outside agencies.

The long-term planning effort focused on ways to offset demands for future imported water purchases, which are projected to be 291,395 AFY in 2035 without any additional conservation and reuse (refer to Figure ES-10).

The long- term concepts build upon 2035 goals for recycling through GWR and additional NPR that together could achieve 123,368 AFY of imported water offsets (as shown in Figure ES-11). The remaining imported water offset target for long-term concepts is up to 168,027 AFY.

Three different milestones were evaluated that would allow the City to offset between 40 and 100 percent of the total 168,027 AFY demand for purchased imported water with recycled water. The long-term milestones are shown in Table ES-7.

Table ES-7: "Milestone" Basis for Long-Term Concepts

Percent MWD Offset "Milestone"	"Milestone" Basis
40 percent	This is the "baseline" condition prior to implementation of long-term concepts. It includes planned conservation, and 59,000 AFY of recycling by 2035.
90 percent	This is the first milestone for long-term concepts. It is based on the estimated groundwater recharge capacity of San Fernando, Central, West Coast, and Raymond Basins.
100 percent	This is the second milestone for long-term concepts in which all imported water purchases are offset by maximizing recycling.

Definitions Use in Master Planning:

Concept: an individual NPR or GWR project concept

Theme: combinations of concepts packaged together to achieve milestone targets

Milestone: the target volume for future recycled water use that would offset imported water purchases

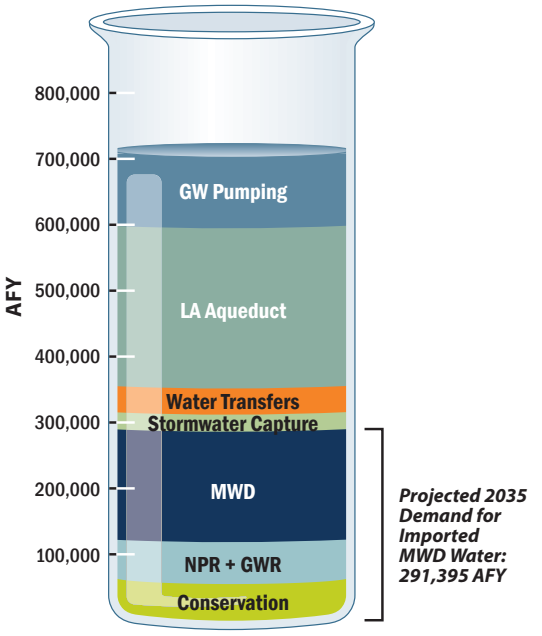


Figure ES-10: Projected 2035 Potable Supplies

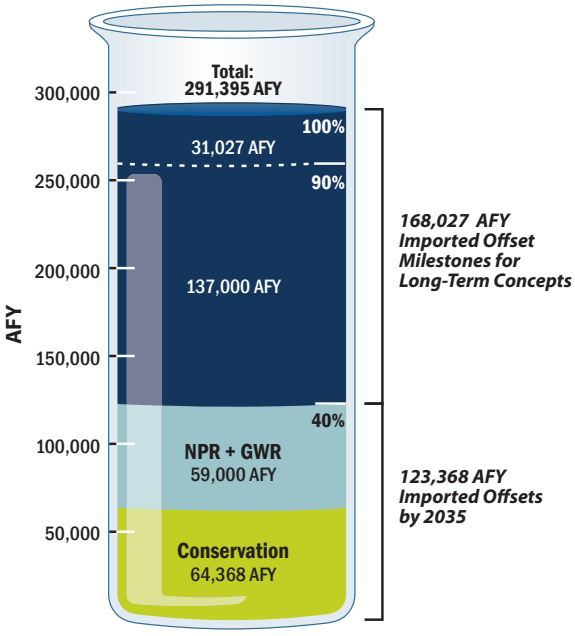


Figure ES-11: Imported Water Offset Milestones (near-term and long-term)

One of the goals for development of long-term concepts was to maximize recycling from the City's existing treatment plants (LAGWRP, HTP, TIWRP, and DCTWRP). However, the long-term objective of maximizing reuse for imported water offsets can also take advantage of non-City sources of recycled water. Figure ES-12 shows the locations of potential recycled water sources and groundwater basins considered for the long-term concepts.

Table ES-8: Potential GWR Recharge Areas

Basin	Recharge Facility	Possible Recycled Water Replenishment
Valley Service Area		
San Fernando Basin	Spreading Grounds	52,000 AFY [1]
Raymond Basin [2]	Spreading Grounds	5,000-10,000 AFY
	Injection Wells	5,000-10,000 AFY
Metro/Westside Service Area		
Central Basin		
▪ Los Angeles Forebay	Injection Wells	40,000 AFY
▪ Montebello Forebay	Spreading Grounds with Recovery	25,000 AFY
Harbor Service Area		
West Coast Basin - Southern	Injection Wells	Up to 50,000 AFY

Notes:

1. Assumes a Groundwater capacity of 57,800 AFY, but replenishment is supply-limited to 30,000 AFY from DCTWRP (for GWR project) plus 22,000 AFY from LAGWRP (for a total of 52,000 AFY).

2. Projects in the Raymond Basin are assumed to be mutually exclusive to projects in the San Fernando Basin.

GWR concepts offer the most opportunity to maximize recycling due to limited amounts of potential NPR demands. Therefore, the long-term concepts focused on potential long-term regional GWR concepts. Potential groundwater recharge capacities were evaluated for basins within and adjacent to the City's service areas. Table ES-8 shows these basins with their associated potential recharge capacities.

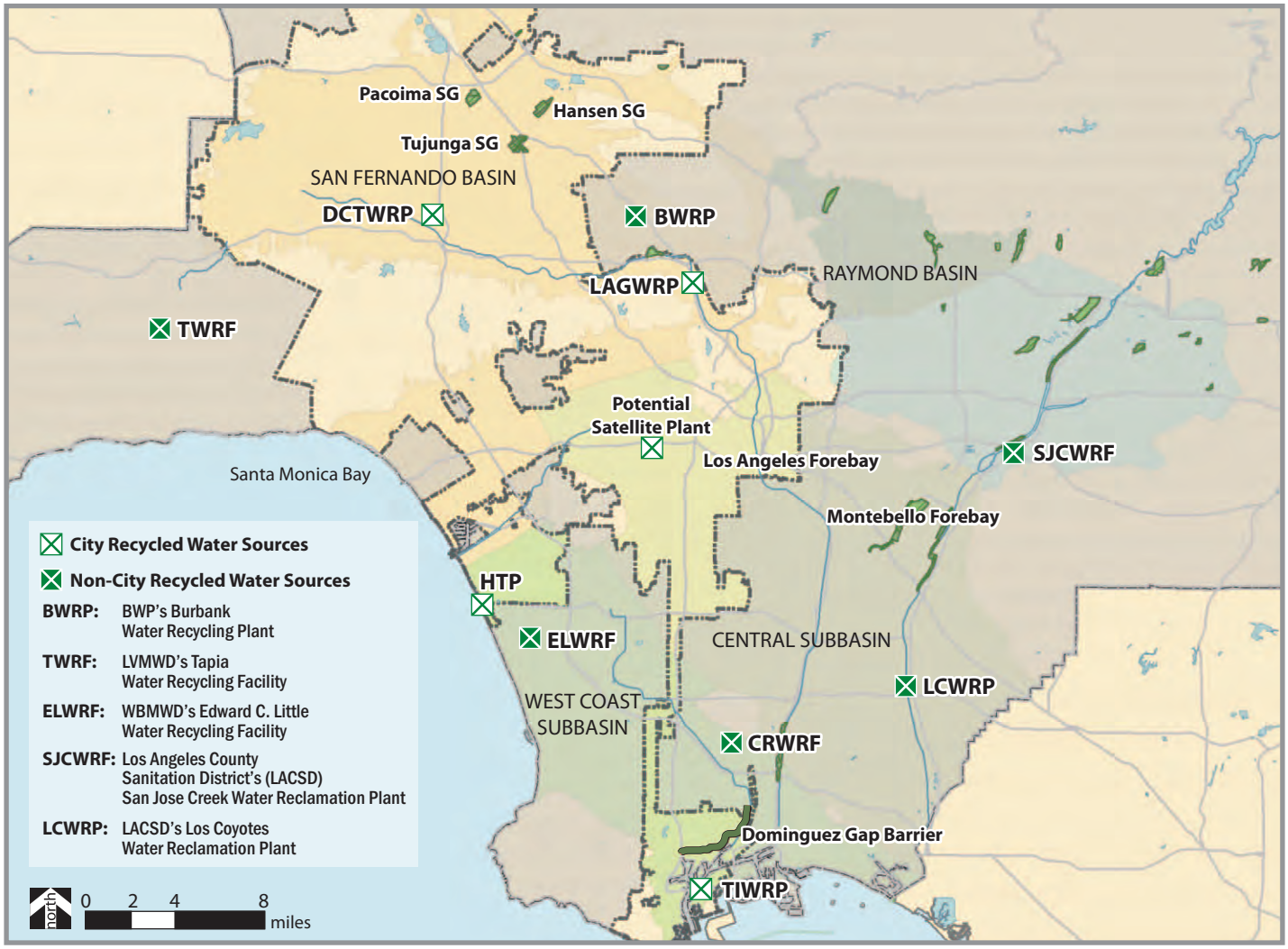


Figure ES-12: Potential Recycled Water Sources for the Long-Term Concept

Each long-term project concept begins from the wastewater collection system and ends at a connection point to LADWP's potable distribution system, consistent with the GWR project described previously. Project concept components include alternative sources of treated recycled water supply, conveyance, groundwater recharge facilities (injection wells or spreading basins), recovery via production wells, and connection back to the potable water distribution system. These components are schematically shown in Figure ES-13 and are located inside the dotted line.

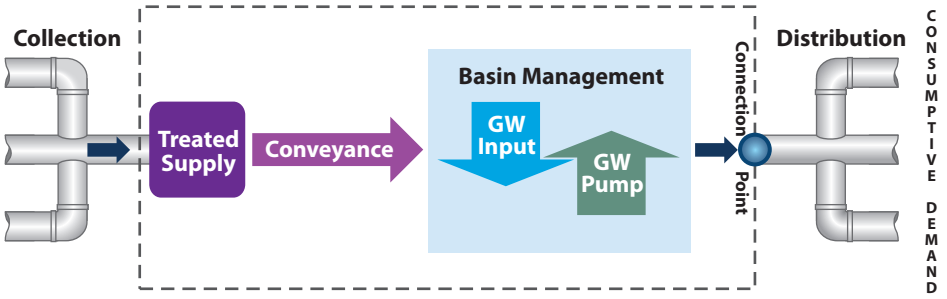


Figure ES-13: Project Concept Development

A total of 10 project concepts were identified in the Valley and Metro/Westside services areas. In the Valley, four project concepts were developed that use tertiary recycled water supply from LVMWD, BWP, or LAGWRP, and treat to purified recycled water quality at either DCTWRP or a potential new AWPF outside the City's service area. The purified water will be used to replenish the San Fernando Basin and/or Raymond Basin.

In the Metro/Westside, six project concepts were developed that use purified recycled water produced at HTP, WBMWD, CBMWD or a newly constructed satellite plant to replenish the West Coast Basin and Central Basin.

Project concepts were packaged together into five themes based on different priorities of where projects would first be pursued: 1) Valley, 2) in the vicinity of the HTP, 3) in the Metro area with a new satellite treatment plant, 4) with outside agencies, and 5) a maximize reuse scenario that prioritized projects with the largest yield.

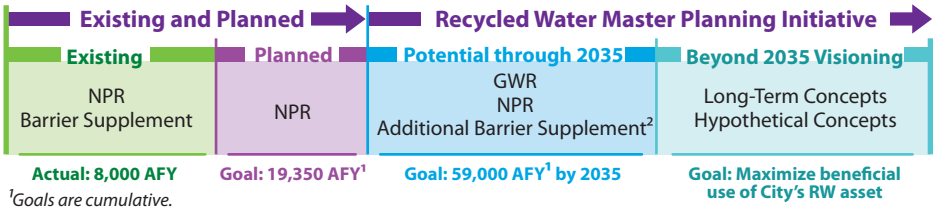
Long-Term Concepts Key Findings

- Any one of the five themes if implemented individually could offset 90 percent of potential MWD imported water demands. The maximize reuse theme could offset 100 percent or more of potential MWD imported water demands.
- Two long-term project concepts that would replenish groundwater basins using recycled water from the HTP would allow the City to offset 100 percent of the imported water demand. One would use injection wells and the other would use spreading basins for GWR in the Central Basin.

Long-term concepts, including the themes discussed above, are presented in the Long-Term Concepts Report for discussion purposes only and are intended to encapsulate the potential pathways available to the City given the current regulatory setting. The long-term concepts represent ideas for maximizing the City's recycled water asset after the near-term reuse goal of 59,000 AFY by 2035 is achieved. One thing to note is that the regulatory landscape for potable reuse, which makes up the predominance of opportunity to maximize the recycled water asset, is changing. As new groundwater replenishment (December 2013) and surface water augmentation (December 2016) regulations are promulgated from California Senate Bill 918, and direct potable reuse framework guidelines are established (December 2016), it is envisioned that new opportunities, hopefully with reduced cost and energy implications, will be available to the City.

Implementation Strategy

This RWMP initiative, discussed in the RWMP documents, provides a clear pathway for the City to achieve its goal of 59,000 AFY by 2035, and potential concepts to maximize recycling beyond that goal. As noted in Figure ES-14, the 2035 goal will be achieved through a combination of GWR and NPR. Key implementation aspects of each of these categories of water recycling are noted below. The timing of projects to achieve the 2035 goal will be dependent on a number of critical factors, one of which is project financing. An overview of project financing options is also presented.



¹Goals are cumulative.

²Additional Barrier Supplement does not offset imported water in the City of Los Angeles and, moving forward, does not count toward the goal of 59,000 AFY.

Figure ES-14: Recycled Water Planning Initiative

GWR: At this time, GWR is envisioned to be implemented in two phases: Phase 1 provides 15,000 AFY recycled water for GWR by the year 2022, and Phase 2 provides a cumulative total of 30,000 AFY recycled water by the year 2035. The implementation of the GWR project will not move forward until the San Fernando Basin Groundwater Treatment Complex is initiated. This is a separate project to clean up legacy groundwater contamination in the basin that will include centralized treatment facilities and wellhead treatment. The Groundwater Treatment Complex will allow LADWP to again have the ability to fully utilize the San Fernando Basin groundwater supplies, including groundwater that has been replenished with purified recycled water. Major implementation steps for Phase 1 include:

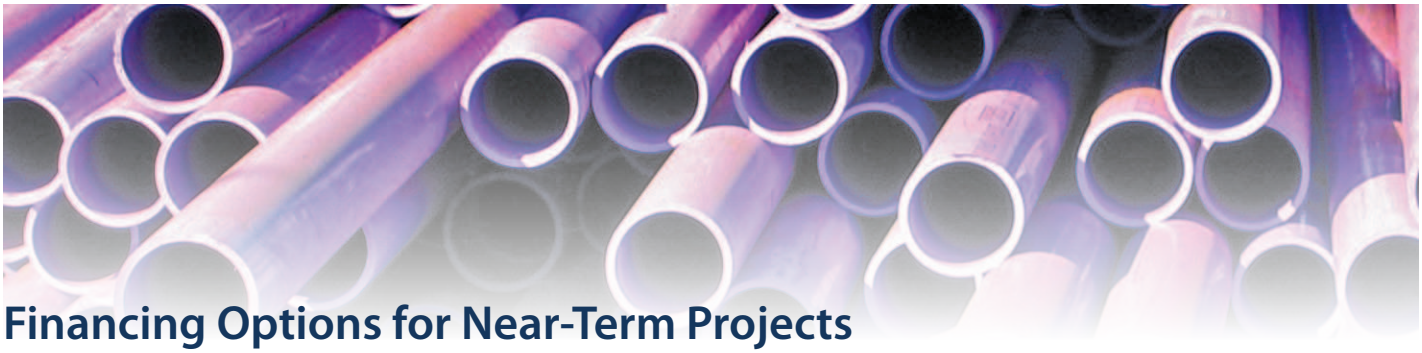
- Prepare engineering report
- Prepare pre-design report
- Show compliance with CEQA and NEPA
- Conduct equipment pre-selection and vendor pilot testing required for prequalification
- Develop final design, including plans and specifications
- Develop bidding and contract award
- Perform construction
- Perform startup and final approvals
- Show compliance with Los Angeles Regional Water Quality Control Board requirements.
- Show compliance with California Department of Public Health requirements.
- Continue with stakeholder engagement and initiate public outreach

Major implementation steps for Phase 2 are similar to Phase 1. However, by the time Phase 2 is to be implemented, it is possible that the State of California may allow direct potable reuse (DPR) as an alternative to indirect potable reuse with GWR. If this happens, the City should reassess the project to determine if DPR would be a feasible option.

NPR: Implementation of the planned (at least 11,350 AFY) and potential (at least 9,650 AFY) NPR projects will be done concurrently with GWR as funding is available. The potential NPR projects anticipated for earliest implementation are those that are most cost-effective and that include anchor customers who are willing to establish a long-term commitment to using recycled water.

Barrier Supplement: Based on the integrated alternatives analysis, GWR and NPR are the preferred strategies for meeting the goal of 59,000 AFY. However, wastewater management goals to reduce treated effluent discharges to the Los Angeles Harbor may drive the need for additional reuse from TIWRP. Options to increase recycling at TIWRP include potential NPR projects or expanding deliveries to the Barrier.

Long Term Concepts: Planning beyond 2035, the City has identified potential long-term concepts that could maximize the City's recycled water asset beyond the near-term reuse goal of 59,000 AFY. These long-term concepts are included in the RWMP documents for discussion purposes only and will be further studied in the future with consideration of updated water demand projections, progress in developing other water supply alternatives, and continued evolution of the recycled water regulatory landscape.



Financing Options for Near-Term Projects

There are different ways that the recycled water program costs could be financed, which impacts not only the total cost of producing recycled water but also the impact to ratepayers of these programs. At the same time, as costs for purchased imported water continue to rise, recycled water is expected to cost less over the long term than these imported supplies, saving ratepayers money and providing valuable additional benefits such as improved operational and supply reliability, since local recycled water is not subject to the short-term and long-term cutbacks that imported water is expected to have

To encompass the potential range of the City's recycled water program costs to achieve 59,000 AFY (combination of GWR and NPR projects), two potential funding methods are presented: (1) "pay-as-you-go" (no financing) and (2) financing using borrowed funds. For both evaluations, the projected cumulative cost is compared with projected Tier 1 MWD) imported water cumulative costs., which is the status quo alternative to recycled water projects.

Pay-As-You-Go Financing

Historically, LADWP has funded its recycled water projects entirely through its Water Rates Ordinance Water Procurement Adjustment Surcharge (Surcharge) without borrowing money. This is called the "pay-as-you-go" method that provides funding during each of the project's planning, design, and construction phases, and also for ongoing O&M costs.

To evaluate and compare future recycled projects for the RWMP documents, a standard economic method called the present value (PV) approach was used. This approach first estimates future capital and O&M costs for the lifecycle of each project, accounting for inflation. Then all future year O&M and capital costs are brought back to PV terms using a discount rate. The discount rate accounts for the time value of money, which captures the economic principle that a dollar today is worth more than a dollar tomorrow because of the opportunity cost or investment potential. Typically the discount rate is set equal to the interest rate if capital costs are financed using borrowed funds. However, for the pay-as-you-go analysis presented in the RWMP documents, the discount rate was set at 3% (equal to projected inflation).

To determine the recycled water unit cost in dollars per acre-foot ($/AF) the sum of the PV costs are divided by the sum of water delivered over the 50-year life of the project. Figure ES-15 shows the PV unit cost for the 59,000 AFY of recycled water projects, which is estimated to be $1,142/AF without injection wells for the GWR project and $1,170/AF with injection wells for the GWR project.

Projecting MWD water rates into the future is very speculative, since annual rate increases from year to year have been highly volatile in the past. In 2010, MWD issued a draft water rate forecast through 2018, which estimates an average annual rate increase of 5 percent. For years after 2018, it was assumed that MWD's Tier 1 water rates would continue to increase at an average of 5% per year. This is considered conservative for the purposes of comparing with recycled water project costs, since the average annual rate increase for the period between 2004 and 2012 was just below 8 percent. The PV unit cost for estimated MWD water purchases over the same 50-year period is estimated to be $1,366/AF, which is about 20% greater than the estimated PV for the recycled water projects without injection wells for the GWR project and 17% greater than the estimated PV for the recycled water projects with injection wells for the GWR project.

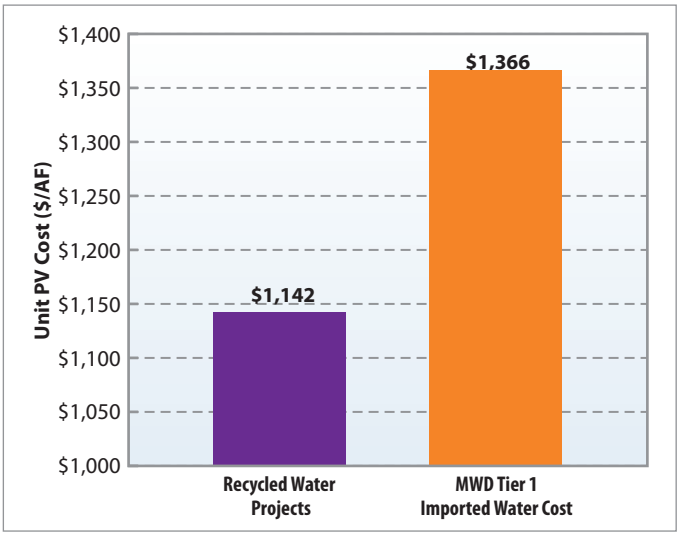


Figure ES-15: Unit PV Cost for the Recycled Water Projects (GWR and NPR) Compared with Projected MWD Tier 1 Imported Water Costs

Alternative Financial Analysis (Long-Term Financing)

An alternative funding approach is to borrow money through long-term financing. Borrowing reduces the near-term impact on customer's water rates, but the costs will have to be repaid with interest over a long-term period.

To determine the annual expenditures of the recycled water projects using this alternative funding approach, the following assumptions were made:

1. Sixty percent of capital expenditures are financed over 30 years at 5% interest, resulting in an annual amortized payment.
2. The remaining forty percent of capital expenditures plus O&M costs are paid using the "pay-as-you-go" method in each future year.
3. All costs include the effects of inflation.

The above costs are projected for each year and added together to arrive at a total annual project cost. Figure ES-16 shows the cumulative annual expenditures over a 50-year period compared to the cumulative costs of purchasing equivalent amounts of Tier 1 MWD water. The same assumption regarding the future cost of MWD water used for the "pay-as-you-go" method was used for this comparison.

The cumulative cost for the near-term recycled water program is $6.23 billion and $6.11 billion with and without groundwater injection wells, respectively. Comparatively, the cumulative cost of purchasing MWD water is $9.37 billion. The payback year for the near-term recycled water program is 2048 with groundwater injection wells and 2046 without. A similar cumulative cost analysis for the pay-as-you-go model yields a 50-year near-term recycled water cost of $5.64 billion (payback year of 2045) with groundwater injection wells and $5.50 billion (payback year of 2043) without groundwater injection wells.

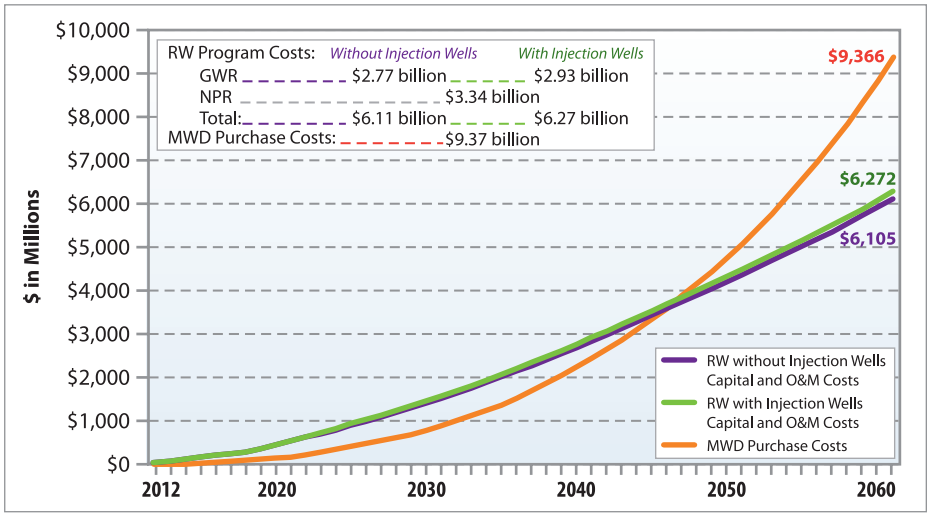


Figure ES-16: Future Annual Recycled Water Project Costs (GWR and NPR) Compared with Projected Annual MWD Tier 1 Imported Water Costs

Summary and Conclusions

The analysis shows that, regardless of the funding strategy, the City's recycled water program to achieve 59,000 AFY by 2035 is less expensive than the cost of purchased imported water from MWD over the long-term. The cumulative MWD water purchases over a 50-year period are expected to be greater than LADWP's near-term recycled water program costs under either financing model. MWD water purchases will be 66-70% greater under the pay-as-you-go analysis and 49-53% under the alternative financial analysis. Over the long term, the near-term recycled water program will cost less than the cost of purchasing MWD imported water.

Recycled water is not only a more cost-effective water supply in the long-term, it provides a local and safe water source that is drought resistant and more reliable than the status quo supplies of purchased imported water from MWD. In addition, recycled water helps to maximize water use efficiency, minimize effluent discharges, and preserve limited resources such as groundwater and imported water. Use of recycled water means that the local water supply will be less affected by imported water shortages and long-term outages. Finally, the City's recycled water strategy will achieve the following planning objectives:

- Meet all water quality regulations and health and safety requirements
- Provide effective communication and education on recycled water programs
- Promote cost efficiency
- Achieve supply and operational goals
- Protect the environment
- Maximize implementation potential
- Promote economic and social benefits
- Maximize adaptability and reliability

By investing in near-term recycled water projects and fulfilling these objectives, the City can help secure a more sustainable water supply for future generations.

Acronyms

AFY	Acre-feet per year
AOP	Advanced Oxidation Process
AWP	Advanced Water Purification
AWPF	Advanced Water Purification Facility
BWP	Burbank Water and Power
BOE	Bureau of Engineering
BOS	Bureau of Sanitation
BWRP	Burbank Water Recycling Plant
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CBMWD	Central Basin Municipal Water District
City	City of Los Angeles
CRWRF	Carson Regional Water Reclamation Facility
DPR	Direct Potable Reuse
$/AF	Dollars per Acre-Foot
DCTWRP	Donald C. Tillman Water Reclamation Plant
ELWRF	E.C. Little Water Recycling Facility
GWR	Groundwater Replenishment
HSG	Hansen Spreading Grounds
H_2O_2	Hydrogen Peroxide
HTP	Hyperion Treatment Plant
IAP	Independent Advisory Panel
LACDPW	Los Angeles County Department of Public Works
LADPW	Los Angeles Department of Public Works
LADWP	Los Angeles Department of Water and Power
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LVMWD	Las Virgenes Municipal Water District
mgd	Million Gallons per Day
MF	Microfiltration
NEPA	National Environmental Policy Act
NGOs	Non-Government Organizations
NPR	Non-Potable Reuse
O&M	Operation and Maintenance
PV	Present Value
RWMP	Recycled Water Master Planning
RWQCB	Regional Water Quality Control Board
RO	Reverse osmosis
PSG	Pacoima Spreading Grounds
SWRCB	State Water Resources Control Board
TIWRP	Terminal Island Water Reclamation Plant
UV	Ultraviolet
UWMP	Urban Water Management Plan
VGS	Valley Generating Station
WBMWD	West Basin Municipal Water District

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Project Team:

City Departments

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Las Virgenes Municipal Water District

City of Long Beach

Los Angeles County Department of Public Works

City of Los Angeles Department of Recreation and Parks

Los Angeles Regional Water Quality Control Board

Los Angeles World Airports

Orange County Healthcare Agency

Orange County Sanitation District

Orange County Water District

Port of Long Beach

Port of Los Angeles

Rowland Water District

Sanitation Districts of Los Angeles County

South Bay Water Recycling

State Water Resources Control Board

Sydney Water

Walnut Valley Water District

Water Replenishment District of Southern California

West Basin Municipal Water District

United States Army Corps of Engineers

The Project Team would like to thank the RWAG for their many hours of dedication to the RWMP process by reviewing materials, attending meetings, and providing valuable input. RWAG includes participants from the following organizations:

Alliance for a Regional Solution to Airport Congestion

Apartment Association of Greater Los Angeles

Arthur Golding & Associates

Baldwin Hills Conservancy

California State Polytechnic University Pomona

Canada Goose Project

City of Burbank - Public Works Department

City of Glendale - Public Works

City of Los Angeles - Department on Disability

City of Los Angeles - General Services - Building Maintenance

City of San Fernando - Public Works

Community Enhancement Services

Council for Watershed Health

Environment Now

Environmental Justice Coalition for Water

First African Methodist Episcopal Church - Assistance Corporation

Food and Water Watch

Forest Lawn Memorial Park

Friends of the Los Angeles River

Friends of the Sepulveda Basin

Granada Hills North Neighborhood Council

Greater Los Angeles Association of Realtors

Greater Wilshire Neighborhood Council

Green Los Angeles Coalition

Heal the Bay - Water Quality

Homeowners of Encino

Japanese Garden Mayor's Citizens Advisory Committee

Los Angeles Community Garden Council

Los Angeles County - Department of Public Works

Los Angeles Urban League

Lake Balboa Neighborhood Council

Los Angeles Unified School District Office of Environmental Health and Safety

Loyola Marymount University - Facilities Management Department

Mar Vista Community Council

Metropolitan Water District of Southern California

Mid City West Community Council

Mono Lake Committee

NASA Jet Propulsion Laboratories

Natural Resources Defense Council

Neighborhood Council MOU Oversight Committee

Oriental Mission Church

Pierce College - Foundation

Proposition O Citizens Oversight Advisory Committee

Providence Holy Cross Medical Center

Providence St. Joseph Medical Center

River Project and Tujunga Watershed Council

San Fernando Valley Audubon Society

Santa Monica Bay Restoration Commission

Sherman Oaks Neighborhood Council

Sierra Club

Silver Lake Neighborhood Council

Society of Hispanic Professional Engineers

South Shores Homeowners Association

Southern California Edison

Southern California Golf Association

Southern California Water Committee

Southern California Watershed Alliance

Southwest Neighborhood Council

Studio City Neighborhood Council

Sun Valley Area Neighborhood Council

Surfrider Foundation

TreePeople

Upper Los Angeles River Area Watermaster

Urban Semillas

University of Southern California - Local Government Relations

Valley Industry and Commerce Association

Van Nuys Neighborhood Council

Vulcan Materials

Watts Labor Community Action Committee

For more information about the Water Recycling Program,
please email recycledwaterinfo@ladwp.com

For general information,
call 1-800-Dial DWP
or visit www.ladwp.com

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LA DWP Los Angeles Department of Water & Power

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