Water Supply Scarcity in Southern California: Assessing Water District Level Strategies

Executive Summary

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Chapter 1. Context and Research Objectives

Rationale for Study

Urban water scarcity is an ongoing reality in California, especially, in Southern California with its arid climate and cyclical droughts. Southern California relies on upstate water imports provided by the Metropolitan Water District of Southern California (MWD) for a significant portion of its water supply. MWD also imports water from the Colorado River, conveyed through the Colorado River Aqueduct. Key to the transportation of water from the mountains in Northern California to the south is the Sacramento-San Joaquin River Delta, vulnerable to aging levees, subsidence and saltwater intrusion. In addition, the environmental deterioration of the Sacramento-San Joaquin River Delta, habitat to several endangered species, has led to ongoing restrictions on MWD water deliveries to Southern California water agencies. This has renewed efforts to both provide for the environmental improvement of the Delta ecosystem, as well as to find a solution for water conveyance, either through a canal, or more recently, through twin tunnels. In addition, the susceptibility of the Sacramento-San Joaquin River Delta to a major Bay Area earthquake increases the threat of disruption of water imports for Southern California.

Climate Change Amplifies Reliability Challenges. The reliability of water supply for Southern California is thus already precarious. Climate change impacts will further aggravate water scarcity throughout the State. According to the State's Climate Adaptation Strategy (2009), snowpack in the Sierra Nevada mountains, a major state source of water storage, is already decreasing and climate change models indicate that precipitation in the mountains will be increasingly in the form of rain, not snow. The State relies on the runoff from the snowpack in the Sierra Nevada to provide water during the warmer months from late spring to early autumn, especially for the southern part of the State. The Climate Adaptation Strategy estimates that the snowpack may be reduced from its mid-20th century average by 25-40% by 2050. Climate change impacts for the State also include a 12-35 % overall decrease in precipitation by mid-century.

California's Water Conservation Efforts. To deal with water scarcity, the State initiated in the early 1990s a voluntary urban water conservation program managed by the California Urban Water Conservation Council (CUWCC), which promoted the implementation of Best Management Practices (BMPs) to achieve more efficient water use. In response to the Governor's call for an aggressive urban water conservation plan, in 2009 state agencies with

water policy responsibility developed a plan with a target of reducing urban water use through conservation measures by 20% by 2020. This target was incorporated into the 2009 Comprehensive Water Package that was passed by the California legislature in November of 2009. The Water Package (CA Dept. of Water Resources 2009a) included an $11B bond issue that was to be voted upon in the November 2010 ballot, allocating several billion to fix the Delta, and funding for conservation and other water initiatives, including the development of Integrated Water Management Plans. As part of the 2009 state legislation, regional and local water districts were required and provided incentives to enact conservation and other measures to develop "diverse regional water supply portfolios that will increase water supply reliability and reduce dependence on the Delta" (S.B. X7-7, Sect. 1, Part 2.55, Chapt. 10608 (c)). Urban water agencies are required to report their baselines and targets to meet 20 x 2020 goals in their Urban Water Management Plans (UWMPs), which are updated every five years.

Study Objectives

Assessing the Effectiveness of Conservation Strategies. The first objective of this study was to determine the effectiveness of recent conservation strategies which urban water districts have developed to deal with water supply scarcity during the past decade in Southern California. Secondly, we sought to examine the extent to which innovative strategies can address, if expanded, greater water scarcity under climate change. To assess how these strategies are working, we studied three cases in the LA metropolitan area, the Los Angeles Department of Water and Power, the Cucamonga Valley Water District and its wholesaler, the Inland Empire Utilities Agency, and Huntington Beach and the regional districts on which it relies, the Municipal Water District of Orange County, and the Orange County Water District. These three agencies receive State water imports through the MWD. Although these agencies vary in terms of their own water resources, customer base, and other characteristics, they have implemented many water conservation strategies (California Urban Water Conservation Council 2008). In addition, these agencies have also implemented or are planning a range of strategies to increase water supply, including purifying recycled water to drinking water standards, and desalination plants. The three cases enabled us to study institutional, demographic/economic, land use, natural and infrastructure factors that shape the plans, and to assess the potential of the strategies used to maintain reliable water supplies in the face of growing scarcity. This part of the study is presented in Chapters 1-6.

Analyzing the Cost-Effectiveness of Strategies. Secondly, we analyzed the cost-effectiveness of the conservation strategies and their capacity to meet 20 x 2020 targets and beyond. With respect to the new supply strategies, we relied on recent studies to identify their relative costs, and focused on conducting an energy and greenhouse gas emissions analysis of several current water supply strategies and compared these to imported water sources, including those from the State Water Project in Northern California. Water imports require conveyance over long distances, and therefore incur energy costs. As a result, because of the energy sources that power

our electricity mix, these imported water sources are an indirect source of greenhouse gas emissions. Chapters 7-9 presents our research on these topics.

Identifying Robust Strategies for the Future. The final objective of the study was to identify the strategies that decision makers from the agencies studied judge to be the most robust strategies across multiple future scenarios that incorporate climate change and other major drivers. To accomplish this, we used scenario planning methodology, widely used in strategic planning and future studies. This methodology enabled us to engage decision-makers in a thought process to elicit their expert judgment on conditions in mid-century. The process developed plausible water future scenarios, which were then used to assess the feasibility of a broad range of water supply strategies. This part of our research appears in Chapters 10-12.

Chapter 2. Water Governance in Southern California

The focus of our study was on the scale of agency that will be required to craft and implement policies and strategies to meet the increasing challenges of water scarcity. We chose to study several local water agencies in Southern California. These local agencies are enmeshed in a complex institutional web of federal, state, and regional agencies.

Federal. The Federal government provides the general framework for state oversight and regulation of water sources. Several dozen federal agencies play some role in water management, but three have continuing important roles: Bureau of Reclamation, Army Corps of Engineering and EPA. For example, the Bureau of Reclamation through its management of the Central Valley Project is partnering with the State in restoring the Bay Delta. Federal legislation can also play important roles in water management. For example, the Energy Policy Act of 1992 accelerated water conservation efforts by setting national standards for water efficient plumbing fixtures.

State. The state institutional framework for water management is complex, overlapping in some areas, and fragmented in others. Agencies in state departments of Natural Resources, Environmental Protection and Health and Human Services split roles in water supply planning and management, rights administration and water quality control. For example, there is a division between the management and planning roles of the Dept. of Water Resources, and the water rights administration and enforcement roles of the Water Resources Control Board. As a recent gubernatorial commission noted, unlike California, in most states water planning and management and rights administration are located together. (Little Hoover Commission 2010). Another recent study (Hanak et al. 2011, 262-263) goes further calling for "One California Water Department" to incorporate the planning and management functions now housed in the Dept. of Water Resources, the water rights administration handled by the Water Resources Control Board, as well as water quality administration.

The Department of Water Resources is the major department in the State in charge of water planning and of the State Water Project (SWP). SWP is crucial to understanding the heightened conservation efforts in the State and the interest in water reliability, since SWP funnels water from the Sierra Nevada through the Bay Delta to Southern California. Using the Delta as a conduit for the SWP further threatens an already imperiled Delta. The Bay Delta Plan is proposing to construct twin tunnels to bypass the Delta, thereby reducing the Delta's vulnerability and increasing the reliability of imported water for Southern California. With a projected cost of $23.7 Billion to be paid by user fees, this project could foreclose other water supply options for Southern California.

In addition to SBX7-7, the 2009 Water Conservation bill that mandated the 20 x 2020 targets of the State's Water Conservation Plan, California has recently enacted several laws and standards that combine to replace inefficient indoor water plumbing fixtures with water efficient ones for new construction starting in 2011, and for the pre-1994 building stock starting in 2014. Also important for reducing outdoor water use was Assembly Bill 1881 (2006), which required DWR to update the State's model water efficient landscape ordinance and local agencies to adopt and enforce either the model ordinance prepared by DWR or an equally water-efficient landscape ordinance by January of 2010. These local ordinances apply primarily to new development. In addition, in 2010, the California Building Standards Commission adopted the new California Green Building Standards Code, CALGreen, which became effective in January, 2011. CALGreen, which requires all local governments in the State to adopt the mandatory provisions of the Code, sets water efficiency standards beyond the 1992 federal standards for all new construction and remodelings. For example, water efficient toilets are required to be high efficiency (HETs) with no greater water use than 1.28 gallons per flush. These changes in all types of indoor plumbing fixtures are calculated to reduce overall indoor water use by 20%. CALGreen also identifies two voluntary sets of standards, Tiers 1 and 2, which localities can adopt to obtain more ambitious water conservation targets of 30, 35 or 40% for new buildings CALGreen also mandates weather or soil-moisture based irrigation controllers for outdoor landscapes, and complements the State's requirements for local water-efficient landscape ordinances. This combination of policies will have a significant effect on water consumption in the State.

Metropolitan Water District of Southern California (MWD). Local water agencies in Southern California depend to a greater or lesser degree on MWD, a unique regional water agency that manages imported water. MWD's imports come from two main sources, the Colorado River Aqueduct, and the State Water Project. MWD provides imported water to Southern California consumers through a more or less complex set of water agencies. MWD has 26 member agencies, which have voting rights on its policies. Some of these agencies (15) are retailers, mostly municipal utility departments, such as Los Angeles Department of Water and Power, and one special district that retails water to customers. The other 11 agencies are wholesalers, that is, they buy in bulk from MWD and sell water to groups of retailers. Typically, these wholesalers,

such as the Inland Empire Utilities Agency or the Municipal Water District of Orange County, also provide other services to retail agencies, such as recycling water, or conservation rebate programs. The customers of these wholesalers could be city departments, for example, one of the clients of the Municipal Water District of Orange County is the Utility Department of the City of Huntington Beach; or they could be special districts that sell water to city residents, for example, Cucamonga Valley Water District provides water for the residents of the City of Rancho Cucamonga.

Prices for MWD water have been increasing. From 2003 to 2011, MWD prices for both Tiers almost doubled, increases which have become controversial. MWD's pricing system includes two tiers, with Tier 1 prices calculated on the average price of water plus maintenance, operations and energy costs; while Tier 2 charges are based on the marginal costs of acquiring new water. Increasing prices, according to MWD, are necessary to maintain and repair the aging infrastructure of the Colorado River Aqueduct and SWP. The increasing price of imported water is a major factor in local water agency efforts to conserve water and to invest in new water supply sources.

MWD dedicates a portion of its revenues, raised through its stewardship charge, to fund conservation rebates and other best management practices for its member agencies. According to its 2012 Report to the Legislature, MWD sources also supported local agency efforts that generated about half the recycled water and the grounded water recovered in the region.

Groundwater. The other major source of water for Southern California local agencies is groundwater. The State of California, unlike most other Western states, does not regulate groundwater use at the State level, leaving it to a multiplicity of agencies to manage groundwater rights conflicts. Because of the lack of state regulation, agencies have often reverted to the courts to settle conflicts through adjudications or have made agreements among themselves. But the resulting fragmented nature of such management can lead to overdrafts, saltwater intrusion, and in general, an inability to plan realistically based on future groundwater supplies. However, the State Water Control Resources Board and courts are increasing their awareness of the need for regulating groundwater sources, which has led to an emphasis on conjunctive use, and integrated water management efforts.

Chapter 3. Los Angeles Department of Water and Power (LADWP)

Los Angeles Department of Water and Power (LADWP) is a department of the City of Los Angeles that provides water services to about 4 million residents in a 464 square miles area that includes the City of Los Angeles and parts of Culver City and West Hollywood. The rate of growth of its population, although positive, has been decreasing since 2001. See Appendix 1 for a table summarizing the statistics for the three case studies.

Land use in the department's service area is largely single family residential (42%). Commercial, industrial and institutional (CII) activities cover only 18% of the service area and multifamily residences 11%. Between 2005 and 2010, CII and multifamily residential areas have increased, while single family housing areas have declined.

Water Demand and Supply. Between 2000-2010, average water demand ranged between 513,000 (2010) and 617,000 (2004) Acre Feet per Year (AFY) and water supply came mainly from water imported through MWD (52%) and imported through the Los Angeles Aqueduct(LAA) (36%). Groundwater plays a much smaller role (11% of water supply), and recycled water is marginal (1%). Los Angeles owns user rights over groundwater in the Central Basin (15,000 AFY), in the West Basin (1,503 AFY), in the Sylmar Basin (3,405 AFY), and in the San Fernando Basin (about 87,660 AFY). However, the San Fernando Basin is an established EPA Superfund Cleanup Site. Although some treatment plants currently treat contaminated groundwater and blend it with imported supplies, only about half of the city's adjudicated rights can actually be distributed.

70% of Water Demand from Residential Customers. The district's water demand comes mainly from residential customers. Although the major portion of the water demand comes from single family homes (about 38% of total water usage), in the LAWDP service area multi-family residences make up a sizable portion of water consumption (32%). CII accounts use the remaining 30%. SCAG projections estimate, and its regional Sustainable Communities Strategy (2012) calls for more dense multi-family development. The greater increase in multi-family developments in the next decades projected for the LADWP area will reduce water demand per capita, since multi-family developments use less water per capita than single family households.

Per Capita Water Consumption at Record Low in 2010. Per capita water consumption in 2010 was 117 gallons per day according to DWP plan documents. This low figure was due to a very wet year, as well as the economic recession. Wet years reduce outdoor water supply use. Between 1996 and 2008 per capita water usage ranged between 159 and 139 gpcpd, with variations tied mostly to the weather.

LADWP's Strong Conservation Policy. Water conservation has been relevant for LADWP since the early 1990s. The City of Los Angeles is using all the available tools to reduce water consumption: ordinances (since 1988 the city recommends water saving fixtures in new constructions), rates, rebate programs for indoor and outdoor fixtures and education and information to customers. LADWP, with the support of MWD, launched toilet distribution programs since the early 1990s and claims to have replaced about 1.27 million toilets throughout its service area. More recently the Department has committed to MWD residential regional programs and supplements MWD rebates with its own resources. Rebates for non residential customers have been a large part of LADWP's strategy. Since 2001 the department has supplemented MWD regional programs' rebates and has invested $ 19,703,773 of its own resources. In addition, municipal ordinances regulate the water intensity of indoor plumbing, the

times for lawn irrigation, quality of landscapes for large landscaped areas, as well as supporting on-site rainwater reuse.

Water Rates based on Tiers with Increasing Prices Per Tier. Water rates are based on water usage, with no service fee. The price differential between the two tiers system is large enough to provide an economic signal, however, the pricing system as a whole sends a mixed signal. The water budgets allotted under the different tiers vary by type of account, in particular, single family accounts with larger lots have a larger allotment. DWP could still improve its pricing formula.

LADWP's Dependency on Imported Water. LADWP's Achilles' heel is its large dependency on imported water both from MWD and through the Los Angeles Aqueduct. The limits to LAA's water and the constraints on MWD's water availability are a constant concern for the department. Even by increasing recycled water up to 8% of the total water supply, by accessing 100% of its groundwater rights in the San Fernando Basin and by adding 30,000 AFY of recycled water to its groundwater supply LADWP will still have to rely on imported water to supply about 74% (including transfers) of its demand.

Likely to Meet its 20x2020 Conservation Goals. In terms of water conservation, the department is not likely to have trouble meeting its 20 x 2020 goals, because, thanks to its low per capita water usage (compared to other areas in California), and to its use of a favorable option to set its baseline for calculating its 2020 target. However, the agency considers water conservation a strategic water supply component and LADWP counts on the replacement of the oldest fixtures, on water savings in outdoor irrigation and on industrial water usage reductions. The investment needed is large and not clearly quantified, with costs ranging between $75 and $900 per each AF of water saved.

Good Credit Rating, but New Capital Investments May Require Price Increases. Moody's ratings in 2012 already warn that "very high debt will require" water price increases. Price increases for a municipal agency can be politically contentious, subject to Mayoral-City Council conflicts and public opposition.

Ambitious Conservation and New Water Supply Plans To Meet Climate Change Challenges. The strategies outlined include increasing recycled water, increasing water conservation, cleaning up the San Fernando Basin Groundwater, enhancing the storm water capture, expanding groundwater storage, and planned green building initiatives over the next ten years. Plans include over $600M in recycling facilities; a share of $940M in groundwater cleanup, $110 M in stormwater capture, as well as sizable investments in conservation.

Chapter 4. Cucamonga Valley Water District (CVWD)

Cucamonga Valley Water District (CVWD) is a special district that retails water to about 199,000 residents in West San Bernardino County, primarily to the City of Rancho Cucamonga. The number of residents in the area grew very rapidly until 2006, at a much faster pace than the rest of the County, and abruptly stopped increasing during 2006-2010.

Land Use in Service Area Split between Residential and CII. Land use in the district service area is almost equally distributed in residential (29%) and commercial-industrial-institutional (CII) (27%) uses. Between 2001 and 2008, CII areas have grown by 30%, while single family residential developments have increased by 11%. Multifamily residential and agricultural areas have been in steady decline. Most of its service area is built out, and the district projects that the area will have a 0.5% annual growth rate through 2035.

Water Demand and Supply. Between year 2000 and 2011, average water demand has ranged between 49,200(2011) and 62,500 (2006) AFY and water supply for 2010 was mainly imported water (49%), groundwater (40%), surface water (7%) and recycled water (4%). Its imported water is obtained through the Inland Empire Utilities Agency, a regional wholesaler water district that, in turn, obtains its imported water from MWD. As of the summer of 2011, CVWD owns water rights to about 5,000 AFY of surface water, about 20,000 AF of groundwater in the Chino Basin, and about 19,000 AFY in the Cucamonga groundwater basins. It uses as much surface water as it can capture, one hundred percent of its Chino Basin rights, but only a small portion (about 3,000 AFY) of its Cucamonga Basin rights.

Demand from Residential Customers, Mostly Single Family. The district's water demand comes mainly from residential customers, the wide majority single family homes (about 55% of total water usage), and only a small proportion multi family. Landscape accounts for about 22% of water demand and commercial/industrial and institutional (CII) uses make the remaining 11%.

Per Capita Demand at Record Low. In the CVWD service area, per capita daily water consumption in 2010 reached a record low of 215 gallons. From a high in the late 1990s of 300 gallons per capita, it has fluctuated, but declined steadily since 2007. Residential usage, however, has declined steadily between 2000 and 2004 and has settled at a constant 200 gpcpd from 2004 to 2010, which implies that the fluctuation is occurring in the CII sector.

Strong Conservation Policy but Residential Indoor Conservation Strategies are Reaching Saturation Point. The district's conservation strategy has focused on water rates and educational activities about outdoor water usage. However, it advertises and facilitates access to regional programs managed by MWD and IEUA. Residents in the district have been eligible for MWD's and IEUA's water conservation programs, rebates for residential and non residential customers since the 1990s. Between 2003 and 2010, MWD and IEUA have invested in CVWD service area about $2.7 million in rebates. IEUA estimates that residential indoor conservation products have

reached more than a 75% saturation rate. As a result, although the largest residential conservation effort had been focused on high efficiency clothes washers, in the last few years the focus of the regional agencies has shifted to outdoor irrigation and smart irrigation controllers, which now represents the largest residential investment in conservation. CII water conservation rebates have been directed toward toilet replacement and, more recently, toward reducing outdoor irrigation.

Pricing System Uses Tiers, but Ineffective Price Differential. Since 2010, the district has implemented a tiered rate system for all its customers, with rates that range from $1.57 to $2.46 for hundred cubic foot (HCF) in 2012. However, the price differential between tiers are no greater than about 21%, short of the 50% differential recommended by water efficiency experts.

Water Supply Plans call for Increasing Ground, Surface and Recycled Water. Although currently dependent on imported water for 49% of its supply, CVWD estimates that with its substantial ground water and surface water rights, and its ability to increase its recycled water supply, it can reduce its reliance on imported water to 43% of its total supply by 2035. In particular, its water rights over the Chino Basin are strong, the Basin is well managed by its watermaster, and the district can rely on IEUA's supply of recycled water for replenishment. In addition, the district does not use 100% of its rights over the Cucamonga groundwater basin and could increase production from that source.

Likely to Meet its 2020 Target. In terms of water conservation, CVWD will have the opportunity to take advantage of water conservation programs implemented by IEUA and MWD. IEUA estimates that in the next 5 years the agency will be able to implement programs to save about 4,500 AF of water. If CVWD is as effective as it has been between 2003 and 2010 it will be able to save 17% of the water saved with conservation programs in the IEUA service area. The district will also benefit from water conserving building codes and landscape ordinances adopted by municipalities in the district's service area.

***Good Credit Rating but Lower than Expected Debt Service Coverage*.** Lower than expected debt service coverage may hinder the District in issuing bonds to finance wells or reservoirs to increase its ground or surface water supplies.

Plans Fail to Take into Account Climate Change. CVWD plans do not adequately take into account the potential effect of climate change on surface water and groundwater replenishment, with same supply projections for these sources through 2035.

Chapter 5. Huntington Beach Utilities Department

The City of Huntington Beach, through its Utilities Department, provides water services about 204,000 residents in a 28 square mile area that includes Sunset Beach and a portion of

unincorporated Orange County. Since 2001, its rate of growth has been in decline, and, according to California Department of Finance data, its rate of growth was negative between 2004 and 2009.

Largest Land Use is Single Family Residential. Land use in the department's service area is largely single family residential (42%). Commercial, industrial and institutional (CII) activities cover 26% of the service area and multifamily residences 17%. Between 2001 and 2008, CII and single residential areas have grown, while multi family declined. But the City has limited space for further expansion.

Water Demand Dropped during Past Decade, Groundwater Major Source of Supply. Between year 2000 and 2010, average water demand ranged between 29,500 (2010) and 35,400 (2000) AFY and water supply came mainly from water local groundwater (68%) and to a lesser part (32%) from water imported through the Municipal Water District of Orange County (MWDOC), a wholesaler member agency of Metropolitan Water District (MWD). Huntington Beach owns correlative right over the Lower Santa Ana River Groundwater Basin and is a member of Orange County Water District (OCWD). OCWD establishes the yearly Basin Production Percentage its member agencies are allowed to extract from the basin without incurring replenishment costs.

Water Demand Primarily Residential. The agency's water demand comes mainly from residential customers. The majority of the water demand comes from single family homes (about 48% of total water usage), and a sizable portion from multifamily accounts (21%). CII accounts use 15% and landscape dedicated accounts about 9%.

Per Capita Consumption at Record Low at End of Decade. Per capita water consumption in 2010 was 124 gallons per day, the lowest recorded in over a decade. Between 1996 and 2008 per capita water usage ranged between 170 and 124 gpcpd. Since 1999, per capita water usage has been constantly declining. The recent economic downturn and an exceptionally wet year led to a drastic reduction in usage throughout all the utility accounts in 2010.

Participates in Conservation Rebate Programs from Regional Agencies. Active water conservation measures have been implemented in Huntington Beach since the late 1990s. The city has participated in all the water conservation rebates for residential and non residential customers put forward by MWDOC and MWD, but has never added resources to regional programs. Its customers have been awarded 6% of the rebates awarded to customers in Orange County between 1995 and 2010, while using 5% of the total imported water. Huntington Beach has also launched small in-house programs (such as discounted water barrels) and approved a landscape ordinance, a water management ordinance and an ordinance that allows the reuse of grey-water systems for lawn irrigation.

Flat Rate Water Pricing. Water rates do not encourage water conservation. Apart from a service rate that varies according to meter size, water is priced at a flat rate, $1.75 per hundred cubic foot.

Can Meet Conservation Target but Lacks Strong Plans for Conservation. Huntington Beach has consistently reduced its per capita water consumption in the last 10 years thanks to rebate programs and intense home tenancy turnover. Thanks to the flexibility of SBX 7-7, it is not likely to have trouble meeting its 20 x 2020 goals. However, the city's water projections for the future, do not take into account the potential of water conservation as a tool to manage water demand and has not quite grasped how water conservation strategies play a role in imported water availability in the future.

Without Own Water Supply, Conservation is Primary Means to Manage Future Demand. Huntington Beach benefits from regional agencies' efforts to increase water supply sources for the region. The City owns and operates some groundwater pumping and distribution infrastructure, but OCWD is the agency that owns and operates the region's recycling water facilities, which benefit the City through increased groundwater availability. Huntington Beach's water supply could also be augmented in the future by desalinated water from the Poseidon private desalination plant being developed within the City. Another water supply initiative, large-scale storm water capture is likely precluded as an option for the City due to its largely built out conditions. This leaves conservation as the primary means through which the City can reduce consumption and manage increasing prices in the future.

City Lacks Realistic Plans for Addressing Potential Climate Change Impacts on Groundwater and Imported Water Sources. The city's UWMP fails to mention the need for additional savings beyond the 20 x2020 target, and the targets are met in a "normal year", while in the single dry year scenario, as well as in the three dry years spell scenario, per capita water consumption in 2020 will exceed 20 x 2020 targets respectively by 12% and 13%. In addition, instead of plans to reduce dependence on imported water sources, the city projects that it will increase its reliance on imported water from the current rate of 32% to 38%.

Chapter 6. Comparison of Case Studies and Cross-Cutting Policy Issues

Basic statistics for the three water agencies are provided in Table 1 found in the Appendix to this summary. Cross-cutting policy issues emerging from the comparison are summarized below.

Institutional structure can influence the range of conservation strategies available for direct implementation to the agencies, that is, municipal agencies, as part of municipal governments, can have more influence on adoption of local land use and building regulations to conserve water. For example, municipal water agencies can influence their city councils to adopt higher level of water conservation measures for new construction through municipal adoption of more stringent voluntary Tier standards than those required by CALGreen Building Standards.

Residential Densities and Outdoor Water Use. Single-family residential districts, especially low-density, because of their outdoor water use are major drivers of urban water demand. The number of dwelling units per acre or residential density is an important factor in determining outdoor water use. In general, the larger the lot, or the lower the density, the greater the outdoor water use. Thus, because of the larger lot zoning prevalent in its service area, CVWD has a greater challenge reducing total water use compared to both LADWP and Huntington Beach. Conservation opportunities in the future could be increased through more integrated urban water management plans and urban planning.

20 x 2020 targets are likely to be met by water agencies due to the favorable targets set by the agencies, and to the federal water efficiency standards implemented since 1994 and more recent State building standards and landscape regulations for new construction.

Plans for new water supplies vary by agency and depend on the institutional structure and scale of the agency. The institutional structure, and the extent of direct or indirect management of resources are important factors in explaining the differences in planned water supply initiatives. LADWP manages directly its own imported water supplies through the Los Angeles Aqueduct and has great influence on its groundwater supplies, and can directly enter into agreements with its sister agency, Los Angeles Sanitation Department for recycling efforts. As a result, it has an ambitious plan for increasing its own water resources and decreasing reliance on MWD by 2035. CVWD, with its own water rights and surface water resource, has plans for a reservoir to increase its surface water yield, and for two new wells to increase its groundwater yield. It does rely on IUEA (its water retailer) plans for increased use of recycled water, and stormwater capture, to decrease its reliance on imported water reliance in the future. Huntington Beach relies on two intermediary agencies to manage imports and groundwater. Its 2010 plan includes a greater reliance on imported waters by 2035.

Water conservation pricing varies among the agencies from robust inclining block structures, to uniform rate. The issue of increasing water prices and the potential effect of conservation on agency revenues may be a concern for some agencies, a problem which may increase in the future. A water agency that adopts a conservation water pricing system can often face the conundrum of a loss of revenues when the pricing scheme succeeds in reducing water consumption, which in turn decreases the revenue base for the agency. For example, CVWD's 2012 budget (p. 5) discusses how the effect of lower demand has made it difficult for the agency to project future revenues and resulted in layoffs of agency. In general, revenue losses due to lower demand, whether caused by recession, lower growth rates than expected, or conservation efforts could discourage agencies from conservation efforts. There is a substantial literature that discusses the potential effect of conservation programs on water agency revenues and identifies ways to address this issue. LADWP's conservation pricing system is a good model for other water agencies and CUWCC provides a technical handbook on designing, evaluating and implementing conservation rate structures.

Climate Change. Taking into account potential climate change impacts in agency plans varies by agency, raising concerns about the increasing future vulnerability of smaller agencies to climate change. From a review of the agency UWM plans, only the LADWP plan appears to take climate change seriously and is making an effort to understand the impacts of climate change on the availability of imported water from the State Water Project and the Colorado River Aqueduct. The smaller agencies rely on MWD projections and do not appear concerned with the impacts of climate change in their service area. This increases the dependency of these agencies on MWD.

Chapter 7. Water Conservation: Cost Effectiveness

Method. The analysis we conducted followed a two-step methodology, which required finding the avoided cost value of lowered water demand and comparing this to the water agency's conservation costs and water savings. We applied this analysis to LADWP's and CVWD's quantifiable water conservation measures. To find the avoided cost value of the districts of lowered water demand, we completed the California Urban Water Conservation Council (CUWCC)'s spreadsheet model available for this purpose. We obtained agency conservation costs and water savings from published data.

The methodology described and used for the two water districts we analyzed can be applied to other districts to find which of their conservation measures are the most cost-efficient. CUWCC's methodology is a useful and relatively simple analytic tool to enable agencies to develop benefit-cost and cost-efficiency analyses of conservation measures. In general, the methodology used in the analysis is sensitive to planned infrastructure investments, the mix and cost of different water sources, the cost of conservation rebates, as well as other relevant variables. The methodology, however, makes an important assumption, that is, that water savings from BMPs will be used to defer capital facilities for increasing own water supply sources. If water districts pursue both new water supply and conservation, then the greater economic benefits of conservation, which this methodology assumes, are not realized.

LADWP Results. For LADWP, almost all the State recommended BMPs being implemented are cst-efficient with benefit-cost ratios of one or greater. Further, the benefit-cost ratios of the conservation measures vary greatly; some measures have ratios barely above one, e.g., high efficiency clothes washers, while others have ratios above 20. For LADWP, because of its great reliance on costly MWD imported water, many conservation BMPs have very high benefit-cost ratios. For example, outdoor water use conservation devices for LADWP have exceptionally high benefit-cost ratios. This finding supports LADWP's emphasis on outdoor water use conservation devices. All other factors being equal, the differences in benefit-cost ratios can be

used by the district as an investment guideline for future implementation of conservation measures.

CVWD Results. For CVWD, almost all the state recommended BMPs being implemented are cost-efficient with benefit-cost ratios of one or greater. As in the case of LADWP, the benefit-cost ratios of the conservation measures vary greatly; some measures have ratios barely above one while others have ratios above 10. For CVWD, conservation BMPs have positive benefit-cost ratios averaging about 2, with some exceptions. Ultra-low flush toilets for the residential sector have benefit-cost ratios above 5, and weather-based irrigation controllers have a benefit-cost ratio above 11. Synthetic turf is the one BMP with a benefit-cost ratio of .96 that, in the short-run, is borderline for the agency. If the water savings from these BMPs can be used to defer capital investments for water supply initiatives, the benefit-cost ratios increase for all the BMPs, and even synthetic turf has a positive benefit-cost ratio.

Chapter 8. The Future Potential for Water Conservation

Saturation Rates. The extent of implementation to date and in the future or the saturation rate will determine the extent to which water agencies can meet the targets set for 2020 and beyond. Federal or State mandates for water efficient devices or practices establish a date after which only more efficient devices are sold or practices are mandated. Such a date can be used, in conjunction with the natural replacement rates of devices or appliances to determine the saturation rate of quantifiable efficient devices within a district. The 1992 Energy Policy Act, for example, established standards for water efficient showerheads, faucets, and toilets, and after 1994, only water efficient fixtures could be sold in the US. Taking into account the natural replacement rate of plumbing fixtures, we can calculate the saturation rate of efficient devices for a given year. This is the major method used to estimate the conservation potential of plumbing fixtures and appliances, since empirical studies of the saturation of conservation devices are costly, requiring site visits. For example, the only empirical saturation study for Southern California, the Orange County Saturation Study (2002) determined the saturation rates in the region for water conserving showerheads and toilets. The Study conducted surveys and site visits, 7 years after the implementation of federal mandates for the sale of water efficient devices. Saturation rates among single-family households were higher than for multi-family households for both water efficient showerheads and toilets, suggesting the need to tailor agency rebate and education to multi-family properties.

Technology and Future Savings. Technological innovation has increased the efficiency of some devices and appliances, such as showerheads, toilets and washing machines. For example, more efficient toilets have decreased their water use from the traditional pre-1994, 3.5 gallons per flush, to the Ultra-Low Flush Toilets, post-1994, with 1.6 gallons per flush, to the current High

Efficiency Toilets, using ≤ 1.28 gallons per flush. Note that the percent water savings from the second innovation is smaller than from the first innovation, representing decreasing returns.

***Outdoor Water Use*.** Potential savings in outdoor water use in the agencies studies can be significant, since it represents from 40-50% of their total water use. Targeting outdoor water inefficiencies, water agencies in the metropolitan area increasing their financial rebates for pop up rotating nozzles and weather-based irrigation devices. CALGreen, California's new building code, in effect since January 1, 2011, requires weather-based or soil-moisture based irrigation devices for new construction. However, no federal or state standards for irrigation devices have been established. Since no standards for such devices have been established, natural turnover rates cannot be relied upon to reduce the number of inefficient devices. This will require active agency efforts.

CALGreen and New Construction. California's new Building Code requires that water efficient devices in new construction reduce water use by 20%. As the economy improves through the end of the decade new construction will help reduce water agencies' per capita water use. In addition, State law required that California cities and counties adopt water efficient landscape ordinances for new construction by January of 2010. The use of these new landscape ordinances to review development proposals will also contribute to reductions in water use.

***Conservation Potential*.** Through natural replacement, state standards, CALGreen and agency efforts, most indoor residential devices will have reached saturation by 2020. As it is, water agencies are offering fewer rebates for indoor residential devices and concentrating their efforts on other sectors. There are opportunities for improving water efficiency in the indoor CII sectors and in Residential and CII outdoor sectors. Water agencies studied are currently concentrating their efforts on these sectors.

It is likely that agencies can meet additional 20% reductions in per capita water use beyond 2020 through conservation efforts in residential outdoor use, and in CII indoor and outdoor water use through more efficient devices. In addition, the water agencies studied could also achieve water savings beyond 2020 by adopting more efficient water conservation pricing, by metering indoor and outdoor water uses, and finally by setting differential rates for indoor and outdoor water consumption.

***Meeting 20 x 2020 Conservation Targets*.** Favorable baselines will likely permit water agencies studied to meet their 20 x 2020 targets without great effort, which implies that they can achieve significant water savings beyond 2020. CVWD, with its low density residential areas is most constrained in increasing water savings beyond 2020. This will require active agency efforts to reduce outdoor water consumption in both residential and CII sectors.

Chapter 9. The Energy and Emissions Intensity of Urban Water Supply Sources in two Southern California Water Districts

Method. An innovative methodology combining life cycle assessment and spatial analysis was applied to LADWP's and IEUA's water supply sources to assess the amount and intensity of their energy use and their associated greenhouse gas emissions. Water sources included in the analysis were imported water from the State Water Project, LA Aqueduct, Colorado River Aqueduct, Groundwater, Recycled Water, Surface Water and Groundwater Desalination. Energy mixes from the different utilities providing energy to the water agencies were incorporated in the analysis. Emissions date from the various energy sources were estimated based on a literature review. The analysis calculated the energy needed for transportation/conveyance of water to its treatment location, the energy required for treatment, and the energy required to deliver water from the treatment location to customers.

Results. Securing a reliable supply of water for Southern California requires reliance on a number of geographically diverse sources. Transporting, treating and distributing the water requires varying amounts of energy inputs depending on the source. This relationship between water imports and energy intensity, however, is not simple. While importing water via the Colorado River and California Aqueducts is quite energy intensive, for instance, importing via the Los Angeles Aqueduct requires no net input of energy since the aqueduct is entirely gravity fed. Similarly, different treatment plants consume different amounts of energy to treat a given volume of water. This is largely dependent upon the specific treatment technology utilized at each plant.

For LADWP, the most energy inefficient source, measured in kWh/AF, as well as the source with the highest GHG emissions was the State Water Project East. The least energy intensive sources of water are the LAA and groundwater on a per acre foot basis. Thus, water purchased from MWD that is sourced from the SWP and Colorado River Aqueduct are the most energy intensive.

For IEUA, imported water from MWD sourced from the SWP and CRA are the most energy intensive as well, although these imports represent a smaller percentage of their total water supplies. The most energy efficient sources of water for IEUA are surface and groundwater.

The energy costs of transporting water from the source to the local treatment plant is the major determinant of energy and emissions intensity for the agencies studied. As utilities in Southern California try to meet future demand, they should consider the energy it takes to convey the water from its generation source to the water treatment plant, rather than focus on the treatment and distribution energy required.

Incorporating energy and emissions intensity of water sources in UWMPs can begin to integrate State environmental goals. Including such an analysis in UWMPs can ensure that water agencies take into account the energy intensity and greenhouse gas emissions of their water

supply decisions. It can also provide a basis for the State to begin to coordinate its energy, water and climate action plans and strategies. As water agencies consider new water supply options, such as water recycling, storm water capture, or desalination to augment their own sources of supply, this type of analysis will provide a fine-grain accounting of the energy and emissions cost or savings of the options they consider.

Chapter 10. Climate Change and Southern California Water

Under Climate Change the Future Amount of Water for Human Consumption Will Change. The future amount of water available for human consumption is not likely to be the same, nor is it likely to be a linear projection of past trends. According to most projections there is wide uncertainty about how water resources will be affected by climate change, but agreement that every part of the hydrological cycle will be altered.

Uncertainty About Climate Change Impacts on Precipitation in California. One of the possible futures of average precipitation in California is included in a range between a slight increase, in case of a low carbon intensive future, if the climate system is not too sensitive to GHG emissions, and a sharp decrease, with a serious drop in the last part of the century that could reach -26% by 2100.

Projections about the future of California snowpack are quite consistent. Most researchers agree that, snowpack available on April 1st will decrease under any emission scenario and by 2100 could possibly be reduced by 89%. There is also a high degree of confidence that snowmelt runoff will shift earlier in the spring with less water in rivers and streams in spring and summer.

Water Management will be Key to Climate Change Adaptation. Many researchers agree that water management will be the key to adaptation to climate change. Relative water scarcity is likely to encourage more water transfers, more extensive conjunctive management and a more effective exchange between agricultural and urban uses.

Chapter 11. Scenario Planning

Scenario Planning refers to a set of methodologies for long-range strategic planning in contexts of uncertainty. Contexts of uncertainty typically involve situations far enough in the future that forecasts and probabilities are not available. Although there are alternative approaches to scenario planning, a major approach sets out an 8-step process that begins with agreeing on a focal question, and goes on identify drivers and influences, chooses criteria to select the

scenarios, fleshes out the scenarios, and goes on to determine the implications of the scenarios. Scenario planning exercises are driven by a policy interest, stated as a focal issue or decision, which guides the choice of drivers, and the scenario narratives. The scientific basis of scenario planning lies in the use of empirical trends and models in the analysis of social, technological, economic, environmental and political drivers. The scenario development process typically revolves around the choice of the two most important and uncertain drivers. These two drivers are used to form the axes of a matrix which is used to generate alternative plausible scenarios. Based on the matrix, stakeholders flesh out the scenario narratives. Once plausible scenarios are developed, groups of stakeholders can use them to determine the feasibility of available policy options to address the focal issue or decision. The ultimate use of scenarios is to assess the feasibility of policy options across alternative futures.

Recent Use of Scenarios by Water Agencies in Southern California. There is an increasing use of scenarios in strategic planning, with many approaches. Two recent uses of scenarios in water management illustrate their increasing use and variation. IEUA's use of robust decision-making provided the agency with a model-based analysis that incorporated several important economic and environmental drivers, including climate change, characteristics of the agency, and performance measures, and used the existing plans of the agency to assess its vulnerability in a large set of alternative agency scenarios. The scenarios were used to engage the agency in an assessment and revision of its plans. In a separate exercise, MWD used another model based approach to generate alternative scenarios for the agency's role which varied from a central role in securing the reliability of imported water, to a central role in securing alternative regional new water supply sources. Through its modeling capacity MWD was able to develop scenarios for alternative future roles that still ensured the reliability of water supply for the region but at varying costs.

Chapter 12. Water Futures Scenario Workshops: Process and Results

The two scenario workshops we conducted during the Summer of 2012 used well-known scenario planning methodology, following an approached pioneered by Shell strategists, to guide participants in developing scenarios. The workshops were designed to engage stakeholders in the process. Major water agency stakeholders, including directors and managers, were invited to and participated in the workshops. Participants received briefing materials before each workshop. The workshops were interactive, with most of the time devoted to small group discussions.

The focal question guiding the workshops was: Given a range of plausible scenarios that include climate change, what decisions or strategies could ensure that water districts in the metropolitan area provide reliable water supply to Southern California customers in 2050?

First Workshop. After establishing the focal question, the first step was to select the second driver, alongside climate change, that would provide the backbone of the scenarios. The selection process for the 2nd driver was interactive, involving break-out group discussions and voting on the final choice. The participants had a choice of a wide range of drivers under the broad categories of Water, Society, Economy and Governance. The majority of the participants voted for Governance as the 2nd most important and uncertain driver. The participants identified fragmentation and integration/collaboration as the end-points of the governance variable. The end points for climate change were a 4 °F increase (low end) and a 7 ° F increase (high end). On the basis of these two variables, four scenarios were sketched out by the workshop participants.

***Four Water Futures Scenarios*.** The four scenarios ranged from a 4-7 ° F average increase in temperature and a fragmented vs. more integrated governance structure. Scenarios emphasized how the combination of fragmented governance and high levels of warming could lead to chaotic situations where local providers could be left with few and unappealing options, and how even under a scenario of average climate change with fragmented government, options tended to be piece-meal and short-term with no assurances about reliability.

***Critical Interaction of Governance and Climate Change*.** The choice of governance as the 2nd driver confirms recent state-wide studies noting the fragmented nature of water management in the State. Stakeholders in choosing governance as the 2nd driver, were also reflecting on the issue of political will, an issue of great concern for the stakeholders because of the reliance on imported water by Southern California water agencies, and the political controversies over improving the reliability of imported supplies by constructing a canal or tunnels to bypass the Delta.

Second Workshop. In the 2nd workshop, the main objective was to identify strategies that would perform well in specific scenarios, and then to evaluate the strategies. This workshop was also interactive, and break-out groups focused on one scenario, identified at least 3 strategies, and then went on to evaluate their feasibility in terms of several criteria, including efficacy, implementation and operational concerns, and social and environmental impacts. The participants identified different sets of strategies for the scenarios, but analyzing the results across the scenarios identified some robust strategies.

***Most Robust Strategies: Recycling and Stormwater Capture*.** The two strategies considered to be the most feasible across the scenarios, and therefore, the most robust, were recycling and stormwater capture, with the highest scores. Both of these strategies are less energy and emissions intensive than imported water. Recycling water is a strategy available to most water agencies, since it only requires control over the wastewater generated in their service area. It does not require groundwater rights or banking. Also, although the infrastructure and operational costs for recycling water are not insignificant, they are not as high as the costs for desalination.

Stormwater capture was also a top ranked strategy by two of the scenarios and, especially for agencies with groundwater rights in a basin, stormwater capture is a more cost-effective, as well as a less energy and emissions intensive water supply strategy than recycling.

Reallocation of Agricultural Rights. Reallocation of agricultural water rights was evaluated as a strategy by one of the scenario groups but did not receive a high evaluation score. However, this is an important policy issue at the intersection of climate change and governance, since the potential reallocation or trading of agricultural water rights has significant implications for the cost-effectiveness of long-range investments in water infrastructure projects.

***Skepticism about Climate Change*.** A group of participants in the workshops we conducted disagreed with the premise that climate change will be a major driver of water resources in Southern California. For example, in the first break-out session, one of the groups disagreed with the choice of climate change as a major driver.

Chapter 13. Recommendations

Several policy recommendations are suggested by this study.

Federal/State

Standards for Outdoor Water Irrigation Devices

1. Invest in technological innovations to reduce urban outdoor water irrigation and in field testing of irrigation fixtures. In order to accelerate conservation in outdoor water use, we need a comparable set of standards as the 1992 Energy Policy Act required for indoor water devices. California already passed a law (AB 1881 2006) requiring the California Energy Commission to set standards, but the CEC suspended the process in 2009 due to insufficient evidence of the effectiveness of current devices.

2. Once in-field testing demonstrates effectiveness of devices, set standards.

State

State Water Planning

3. Develop a coordinated strategy for water management in the State that incorporates the State Water Project/Bay Delta Conservation Plan, climate change adaptation, water conservation, and water quality, and regional groundwater and other water supply strategies. All of these elements require substantial investment to ensure a sustainable water supply future for the State. Some investments, such as SWP proposed tunnels will

preclude others due to financial constraints. Trade-off analysis and full-accounting (including energy and emissions intensity of options) should be included in such analyses.

4. Develop a Southern California Regional Groundwater Strategy, which incorporates IRWMP efforts, to determine the federal, state, and local actions required to fully benefit from existing groundwater resources in the region and to plan and finance a coordinated set of groundwater remediation to improve water quality and new regional supply projects, including, stormwater capture, conjunctive management, recycling and groundwater desalination projects. Such a strategy should also examine the contributions that water banking and water markets can play in Southern California's future water supply.

5. Recommend ways to integrate water, land use, energy and climate change mitigation and adaptation planning in other state, regional and local planning processes. For example, the State could consider adding a water conservation element to the Sustainable Communities Strategies required by SB 375. SB 375 already aims to integrate regional land use and transportation planning with climate change mitigation. Incorporating water conservation in the SB 375 planning process would add the water (and associated energy and emissions) savings of higher density development to their transportation savings.

6. Determine the feasibility of public-private partnerships and other financing mechanisms for new water supply projects. With increasing investment in new water resources, some Southern California water agencies may face debt ceiling in the future, and could benefit from the use of other promising financing mechanisms.

20 X 2035 Water Conservation Plan

7. In the next water conservation plan, provide fewer choices on methods to determine water agency baselines; future method(s) should ensure more challenging targets.

8. Require outdoor metering for residential uses.

9. Require more effective conservation pricing.

10. Identify suites of conservation strategies suitable for different types of institutional structure. For example, a municipal retailer, such as Huntington Beach's water utility, without direct management of supply, could benefit from more specific guidance on which BMPs it should target.

Revise UWMP Requirements

11. Plans should be required to show quantifiable outcomes of their activities in terms of water saved or added, and connect these to projected demand and supply, and include a quantified strategy to get to their target.

12. Provide more specific guidelines for agencies to address climate change impacts on their sources of supply.

Climate Change

13. Continue supporting research on the impacts of climate change on California's water resources. Although there is wide agreement on the impacts of climate change on snowpack, the impacts of climate change on the amount of precipitation are currently uncertain, especially for Northern California. As the climate warms over the next two decades and models and inputs are improved, we can expect the uncertainty to decrease.

14. Provide ongoing education for the water management community, especially for smaller water agencies, on the impacts of climate change on water resources.

Water Agencies

Metering and Pricing Outdoor Water Use

15. Meter outdoor water use for all accounts.

16. Improve existing pricing structures to more fully realize reductions in water use.

17. Adopt higher inclining block conservation pricing for outdoor accounts.

Appendix 1.

Table 1. Comparison of Water Agency Features

AGENCY FEATURES	WATER AGENCIES		
	LADWP	**CVWD**	**HUNTINGTON BEACH**
TYPE OF INSTITUTION	Municipal Dept. Retailer	Special District Retailer	Municipal Dept. Retailer
RELATION TO MWD	Purchases imported water directly from MWD; 2nd largest MWD customer (after San Diego Co. Water Auth.)	Purchases imported water through an MWD wholesaler—the Inland Empire Utility Agency	Purchases imported water through an MWD wholesaler—the Municipal Water District of Orange County
SIZE			
AREA	464 sq.mi.	47 sq. mi.	28 sq. mi.
POPULATION 2010	3.81 million Actual	195,317 Actual	191,490 Actual
PROJECTED POPULATION 2035	4,467,560 (projected on a 4.1 million base at an annual growth rate of .4%)	223,855 (projected on a 199,225 population base at an annual growth rate of .5% through 2030, and .4% through 2035	219,690 (14.7% Growth over 25 years—they estimate a 7.3% growth rate over their 204K pop figure for 2010—would yield 13,788 more people)
WATER SUPPLY PROFILE 2010			
Total Use	546 TAF	52 TAF	29.5 TAF
MWD Imports	52 %	49%	32%
Groundwater	11%	40%	68%
Surface Water	0%	7%	0%
Other	36% LA Aqueduct 1% Recycled	4% Recycled	
WATER SUPPLY PROFILE 2035			
Total Use	710.8 TAF	66.7 TAF	34.66 TAF
MWD Imports	30%	43%	38%
Groundwater	22%	40%	62%
Surface Water	0%	6%	
Other	38% LA Aqueduct 4% Recycled 6% Transfers	11% Recycled	

AGENCY FEATURES	WATER AGENCIES		
	LADWP	**CVWD**	**HUNTINGTON BEACH**
GROUNDWATER RIGHTS	San Fernando Basin: 87,660 AFY Sylmar Basin: 3,405 AFY + 35% returned water Eagle Rock Basin: 100% of yield (185 AF in 2011) Central Basin: 15,000 AFY West Basin: 1,503 AFY	Chino Basin Fixed: 17,786 AFY Depending on recharge: 2,996 AFY Cucamonga Basin: 15,471 AFY	Varies by year, % of groundwater withdrawals set by OCWD
SURFACE WATER RIGHTS	Owens and Mono Lake but environmental protection issues may restrict increases in supply	Cucamonga Creek: 3.24 mgd Unquantified rights over Day/East Canyon, Deer Canyon, Lytle Creek, Smith Canyon Group, Golf course Tunnel.	None
POPULATION GROWTH 2000-10	3.7 million/ 3.8 million +2.7%	150,857/195.317 +29%	190,978/191,490 +0.3%
LAND USE PROFILE			
Single family	40%	27%	42%
Multi-family	11%	3%	17%
CII	18%	28%	26%
Parks & Open Space	13%	42%	10%
Agriculture		1%	1%
WATER USE PROFILE by Use & TAF delivered	No. of Accounts / Amount Delivered	No. of Accounts / Amount Delivered	No. of Accounts / Amount Delivered
Total	695K / 652 TAF	49,1K / 52 TAF	52.4K / 28.9 TAF
Single Family	69% / 38%	92% Single & Multi / 55%	84.3% / 48%
Multi-Family	18% / 28%	/ 8%	7.9% / 21%
Commercial	10% / 17%	1% / 33% CII	4.4% / 12%
Industrial	1% / 4%	1%	0.6% / 2%
Institutional	1% / 7%	3%	1.1% / 0.5%
Dedicated Irrig.	0% / 0%	3% / 3%	1.8% / 9%
Recycled	0% / 1%	/ 1%	/ 2%
Unaccounted	NA / 6%	/ 4%	/ 9%
GPCPD 2000	159	299	165
2005	139	258	145
2010	128	215	124
20 X2020 TARGET	138 gpcpd	228 gpcpd	137 gpdpc

AGENCY FEATURES	WATER AGENCIES		
	LADWP	**CVWD**	**HUNTINGTON BEACH**
CONSERVATION EFFORTS MWD REG WHOLESALER OWN	 Full use N.A. Since early 1990s, through city ordinances, conservation rates, rebate programs	 Full Use General information about outdoor irrigation potential, education, tiered rates and ordinances	 Full Use Ordinances, rebates on rain barrels, encourages gray-water reuse
INDIRECT SATURATION INDICATOR % of households moved in the current dwelling after 2000 in 2010:	67.2%	71.3%	54.3%
MAJOR SECTORS WITH COSERVATION POTENTIAL	Outdoor irrigation Residential, Indoor and Outdoor CII	Outdoor irrigation Residential, CII Indoor and Outdoor	CII Indoor and Outdoor
PRICING	2-tier system with adequate price differentials per tier; each tier has different water allotments for single family, multifamily and CII; however, water allotments for single family residential vary with lot size	4 tier system with small difference per tier only for residential and non residential customers and service charge. Tiers and service charge vary according to meter size.	Flat rate and service charge
PLANS TO INCREASE SUPPLY Recycling Groundwater recapture Stormwater recharge Desalination	 $600 M $940 M with US EPA $110M No	Maximize groundwater usage in accord with watermaster and regional wholesaler and increase use of recycled water.	Not applicable. OCWD is regional water agency that manages groundwater, and recycling. The County imported water wholesaler is MWDOC
FISCAL CONDITION	Good credit rating but new capital projects may require increases in water prices	Good credit rating, but decline of water revenues has impacted the district's fiscal health	Good credit rating with risks related to decline of revenues.
LAST INCREASE IN WATER RATES	2012-2014	2012 - 2014	October 2011
EASE OF INCREASING PRICES	Complicated due to municipal politics	Less difficult for special districts	

AGENCY FEATURES	WATER AGENCIES		
	LADWP	**CVWD**	**HUNTINGTON BEACH**
CLIMATE CHANGE PLANS	Ambitious plan, including investment in recycling, groundwater, and additional conservation	Relies on MWD plans to address impacts on imported water; identifies surface water source as vulnerable, but no plans to mitigate impacts, instead 2035 plans increase reliance on surface water source	Recognizes that City is vulnerable to climate change, but has no mitigation plans and relies on MWD and OCWD. Instead its projections for water supply in 2035 increase reliance on imported water from current 32% to 38%